January 2019
Port of Seattle T-25 South Design Characterization

Port of Seattle

Quality Assurance Project Plan: Soil and Subsurface Sediment Characterization

Prepared for U.S. Environmental Protection Agency

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Prepared for

U.S. Environmental Protection Agency
Region 10
Seattle, Washington

Prepared by

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ABBREVIATIONS

%RSD	percent relative standard deviation
µg/kg	micrograms per kilogram
ARI	Analytical Resources, Inc.
ASTM	American Society for Testing and Materials International
BEI	Blymyer Engineers, Inc.
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
CFR	Code of Federal Regulations
City	City of Seattle
COC	chain of custody
COPC	contaminant of potential concern
CSL	cleanup screening level
DGPS	differential global positioning system
DMMP	Dredged Material Management Program
DQI	data quality indicator
DQO	data quality objective
dw	dry weight
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ESA	Environmental Site Assessment
FC	field coordinator
FS	Feasibility Study
GC/MS	gas chromatography/mass spectrometry
GPS	global positioning system
HAZWOPER	Hazardous Waste Operations and Emergency Response
HPAH	high-molecular-weight polycyclic aromatic hydrocarbons
HASP	health and safety plan
ICP-MS	inductively coupled plasma-mass spectrometry
ID	identification
LCS	laboratory control sample
LUST	leaking underground storage tank
MDL	method detection limit
mg/kg	milligrams per kilogram
MLLW	mean lower low water
MS	matrix spike
MSD	matrix spike duplicate

MTCA	Model Toxics Control Act
NAD83	North American Datum of 1983
OHWM	ordinary high water mark
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photoionization detector
Port	Port of Seattle
PM	project manager
PSEP	Puget Sound Estuary Program
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
QL	quantitation limit
RPD	relative percent difference
SCO	Sediment Cleanup Objective
SDG	sample delivery group
SMS	Washington State Sediment Management Standards
SOP	standard operating procedure
SPT	standard penetration test
SRI	Supplemental Remedial Investigation
SRM	standard reference material
SVOC	semivolatile organic compound
T-25S	Terminal 25 South
TCLP	toxicity characteristic leaching procedure
TM	task manager
TOC	total organic carbon
TPH	total petroleum hydrocarbons
USCG	U.S. Coast Guard
VOC	volatile organic compound
WAC	Washington Administrative Code
Windward	Windward Environmental LLC

1 Introduction

This quality assurance project plan (QAPP) describes the quality assurance (QA) objectives, methods, and procedures for collecting and chemically analyzing samples from soil borings and sediment cores in the vicinity of the Port of Seattle (Port) Terminal 25 South (T-25S; Figure 1) to support the habitat restoration project being proposed by the Port at this location. Data from this investigation will be used to characterize the chemical and geotechnical properties of sediment and soil to support habitat restoration planning and waste characterization for soil and sediment.

This QAPP presents the project objectives, existing data summary, and study design, including details on project organization, field data collection, laboratory analysis, and data management. This QAPP was prepared in accordance with U.S. Environmental Protection Agency (EPA) guidance for preparing QAPPs (EPA 2002).

This plan is organized into the following sections:

- Section 2 – Project Objectives and Background
- Section 3 – Project Organization and Responsibilities
- Section 4 – Data Generation and Acquisition
- Section 5 – Assessment and Oversight
- Section 6 – Data Validation and Usability
- Section 7 – References

A health and safety plan (HASP) designed to protect on-site personnel from physical, chemical, and other hazards posed during field sampling activities is included as Appendix A. Field collection forms are included as Appendix B. Appendix C provides the historical boring logs from previous upland studies and also includes a summary of analytical results from the Supplemental Remedial Investigation (SRI; Windward and Anchor QEA 2014) for sediment sampling locations adjacent to T-25S.

1.1 Restoration Project Description

The T-25S restoration project includes restoration of intertidal and shallow subtidal habitat within and around the footprint of a derelict creosote-piling dock structure, in addition to fill removal from more than 5 acres of adjacent uplands, to create off-channel emergent marsh and riparian habitat. The project will be significant in that it is located in a critical estuarine/marine transition area, important to juvenile salmon. In addition, fine-grained intertidal habitat is rare in the East Waterway and no emergent marsh or riparian resources are present.

Preliminary design has been completed for the restoration project. The project will involve removal of the remaining creosote timber piling, connecting timbers, concrete decking, and associated structures within the footprint of the former dock, which is located between -30 and +10 feet mean

lower low water (MLLW) (Figure 2). In addition, approximately 250 cubic yards of in-water rubble, riprap, debris, and abandoned material will be removed from intertidal and shallow subtidal areas.

Existing topography in the upland area ranges from +12 to +16 feet MLLW (Figure 2). Soil excavation will extend between 400 and 750 feet landward from the ordinary high water mark (OHWM), depending on final design, to achieve off-channel emergent marsh elevations of between +5.5 feet MLLW to +12 feet MLLW. The Port anticipates removing up to 60,000 cubic yards of previously filled upland soil to create the off-channel marsh. All excavation areas will be backfilled with 1 to 2 feet of imported substrate to support habitat functions, depending on the location and elevations of each area. The inlet and outlet of the off-channel habitat will be graded to +5.5 feet MLLW, while the off-channel area will be graded to have a central high point, or saddle, at +9.5 feet MLLW to ensure drainage and prevent fish isolation during extreme low tides. A riparian buffer will line the landward margin of the site and be densely planted with native trees and shrubs.

An intertidal berm will extend along the current waterward margin of the site with wide channel openings at the north and south boundary. The berm will crest at around +13 feet MLLW and will be constructed of anchored and partially buried large woody debris, interplanted with native emergent and transitional vegetation. Off-channel habitat will extend from the berm landward at a 10:1 to 25:1 slope throughout the off-channel area. The on-channel slope will not exceed 6:1 and will gradually transition to existing subtidal slope conditions of the East Waterway with a series of flat intertidal and subtidal benches.

Depending on the location of planned Sound Transit light rail lines that are conceptually proposed just north of Spokane Street, the southern project boundary could be shifted north and the eastern project boundary could be extended farther east. Along the east side of the restoration area, a stormwater pond may be installed that will retain and treat stormwater from the nearby developed areas and be released as a source of freshwater to the restoration area. Public access and a potential trail may also be added to the south and east edges of the project area.

1.2 Regulatory Context

The sediments within the East Waterway are part of the East Waterway Operable Unit (OU) of the Harbor Island Superfund Site. EPA is overseeing the completion of a Supplemental Remedial Investigation/Feasibility Study (SRI/FS) for the East Waterway OU. The SRI was approved by EPA in 2014 (Windward and Anchor QEA 2014), which included the baseline ecological risk assessment, baseline human health risk assessment, and assembled data to identify the nature and extent of contamination in the East Waterway, evaluate sediment transport processes, and identified potential sources and pathways of contamination to the East Waterway. The FS develops and evaluates East Waterway-wide remedial alternatives to address risks posed by contaminants of concern within the East Waterway and is expected to be approved by EPA in 2018. EPA will release a Proposed Plan in

2018 or 2019 that will identify a preferred remedial alternative for the East Waterway. After public, state, and tribal comments on the Proposed Plan, EPA will select the final remedial alternative in the Record of Decision.

Information from the SRI on the nature and extent of contamination of the sediments in the vicinity of T-25S is summarized in Section 2.5 and was used to develop the sampling program described in this QAPP. Remedial technologies that could be employed to address sediment contamination at T-25S are described in the FS. Specifically, all active remedial alternatives include removal of approximately 1,000 treated piles along T-25S (piling field) and removal of contaminated sediment in the piling field area. Two technologies are evaluated for contaminated sediments in the T-25S area: 1) removal; or 2) partial removal and cap (with partial dredging depths assumed to be equivalent to the cap thickness). While the selected remedy in this area will not be identified until 2019 or later, the data to be collected that are described in this QAPP are intended to support planning and design of the T-25S restoration project so that it is compatible with any of the remedial alternatives that will be selected by EPA. While construction of the T-25S project may occur prior to cleanup of the entire East Waterway, the Port will coordinate with EPA during future restoration planning and design to support completion of this high priority project without limiting future cleanup actions in the East Waterway.

2 Project Objectives and Background

This section describes the overall project objectives and presents the site history and existing information used to inform development of this QAPP.

2.1 Project Objectives

Upland borings and sediment cores will be collected to characterize the pre-construction conditions at T-25S prior to the restoration. Data quality objectives (DQOs) for the characterization area are listed below:

1. Characterize the excavated sediment and soil for disposal characterization.
2. Characterize the post excavation surface prior to the placement of fill material.
3. Characterize the sediment and soil geotechnical properties for static and seismic stability evaluations.

The following matrix provides the step-by-step DQO development process used to establish the sampling design.

DQO Development Matrix

DQO Step	DQO 1	DQO 2	DQO 3
STEP 1: State the problem.	Soil and sediment chemistry is needed for proper disposal of excavated material.	The post-excavation surface conditions are needed to evaluate conditions prior to fill material placement.	Soil and sediment geotechnical data are needed to conduct static and seismic stability evaluations.
STEP 2: Identify the goals of the study.	Establish soil and sediment chemical concentrations for excavated material.	Characterize the post excavation soil and sediment chemistry concentrations.	Characterize geotechnical properties of soil and sediment within the site.
STEP 3: Identify the information inputs.	Existing soil and sediment data were reviewed. Sample locations selected based on existing data and preliminary design.		
STEP 4: Define the boundaries of the study.	Preliminary design information used to identify areas where sediment and soil will be removed.	Preliminary design information used to identify post-excavation elevations.	Preliminary design information used to identify representative areas for geotechnical evaluations.
STEP 5: Develop the analytical approach.	Composite samples will be created to chemically characterize excavated material.	Soil boring and sediment core sections will be analyzed as individual samples to chemically characterize post-excavation concentrations.	Standard penetration tests and deeper borings will be conducted to supplement geotechnical testing of representative areas.

DQO Step	DQO 1	DQO 2	DQO 3
STEP 6: Specify performance or acceptance criteria.	Disposal regulations will determine the suitability of the material for disposal.	Sediment and soil concentrations will be compared to applicable sediment criteria.	Industry standards (i.e., American Society for Testing and Materials) will be used to evaluate the geotechnical properties of remaining subsurface soils and sediments.

2.2 Site Use History

T-25S was initially constructed by dredging and filling activities in the early 1900s, when the Duwamish River was reconfigured to the current channel location. In addition to sediment fill placement at T-25S, other upland fill materials (associated with the regrading of Beacon Hill and Denny Hill) were placed. From 1915 to approximately 1930, the location of the proposed restoration project on T-25S was used for cold storage, logging facilities, and as a sawmill. By 1930, the mill operations were expanded. The mill site was removed to allow for lumber storage and automobile staging in the early 1960s. Additional automobile undercoating facilities were constructed in the 1970s. T-25S was acquired by the Port in the late 1970s. During the 1980s, T-25S was used for cold storage, seafood processing, and shipping operations. Most structures and buildings were demolished at T-25S in the 1990s, with the cold storage building demolished in the early 2000s.

2.3 Current Site Use

T-25S is bounded to the east by East Marginal Way, to the south by Spokane Street, to the west by the East Waterway, and to the north by the active terminal facility (Figure 1). The Port currently leases T-25S to various tenants who use the area for equipment and material lay-down, light industrial activity, and truck parking. The southeastern portion of T-25S includes the City of Seattle's (City's) right-of-way and is used as a paved, active construction laydown area. The south-central portion of T-25S is paved with asphalt and is used as a parking area for trucks. The northern portion of T-25S is currently leased by a tenant to the Port and used for concrete crushing and recycling operations. The western portion of T-25S contains paved and unpaved portions and abuts the eastern shoreline of the East Waterway. The southwestern portion of T-25S is used as a log and woody debris storage area. The western and northwestern areas of T-25S are currently unused.

2.4 Existing Upland Areas Data Summary

Existing soil and intertidal bank sediment characterization results from within the T-25S project boundary are summarized in the following subsections. Figure 3 shows historical upland and sediment sampling locations, exceedances of Sediment Management Standards (SMS) marine sediment criteria, and other historical features are described in this section.

2.4.1 *Blymyer Engineers, Inc. (1989)*

A Phase 1 Environmental Site Assessment (ESA) was performed on behalf of Matson Terminals, Inc. (a previous tenant), by Blymyer Engineers, Inc. (BEI; BEI 1989), and included historical research and completion of a series of soil explorations. BEI drilled 12 soil borings (B-1 through B-12) throughout the site to an approximate depth of 10 feet below ground surface (bgs). Boring locations were selected based on historical research of past site uses, and only three of the 12 borings were located within the current Project Area (B-10, B-11, B-12; Figure 3). Boring logs are included in Appendix C.

Soil samples from explorations completed on the site were analyzed for one or more of the following analyses: total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), and/or semivolatile organic compounds (SVOCs). Notable exceedances of soil criteria included the following:

- Boring B-12 at 10 feet: TPH-diesel, TPH-oil and grease
- Boring B-10 at 10 feet: polycyclic aromatic hydrocarbons (PAHs: naphthalene, acenaphthene, fluorene, phenanthrene, anthracene, 2-methylnaphthalene)

As reviewed in Landau and EcoChem 1990 (see Section 2.4.3), the field collection and analytical methods utilized in this study may have overestimated TPH at Boring B-12. The analytical method used for these data (EPA 503E/418.1) may not have utilized a silica gel cleanup, which can result in a high biased concentration due to organic material in the soil. Additionally, the degree to which the field team homogenized the sample interval is unclear. A sample location is planned near B-10 to assess chemical quality in this area with potential elevated PAHs.

2.4.2 *Sweet-Edwards/EMCON, Inc. (1990)*

A Subsurface Investigation Report was prepared by Sweet-Edwards/EMCON, Inc. (1990), on behalf of the Port, to document the excavation and removal of a 3,000-gallon gasoline underground storage tank from the southwestern portion of the site in 1989. Soil samples were collected from the excavation area, and four groundwater monitoring wells (MW-1 through MW-4) were installed (Figure 3). Soil and groundwater samples were analyzed for petroleum-related benzene, toluene, ethylbenzene, and xylene (BTEX) and TPH compounds. Boring logs are included in Appendix C.

Post-excavation soil samples indicated no exceedance of Washington State Model Toxics Control Act (MTCA) soil criteria. Groundwater quality indicated no exceedance of MTCA clean-up levels for groundwater. These groundwater monitoring wells were decommissioned and are no longer present on the site.

In 2012, T-25S received a no further action determination by the Washington State Department of Ecology (Ecology) establishing that no further remedial action was necessary at the site to clean up contamination associated with leaking underground storage tank (LUST) ID 1591 (Ecology 2012).

2.4.3 *Landau Associates, Inc. and EcoChem, Inc. (1990)*

A Soil and Groundwater Investigation was performed near the location of a former maintenance building in the southwestern portion of the site to characterize the chemical nature of soil and groundwater in the vicinity of BEI's Phase 1 ESA boring location B-12 (Landau and EcoChem 1990). Three borings (LW-1, LW-2, and LW-3) were drilled, and groundwater monitoring wells were installed in the vicinity of B-12 to assess potential TPH impacts in nearshore soil and groundwater (Figure 3). Boring logs are included in Appendix C.

Three soil samples were submitted for analysis of TPH (EPA Methods 418.1/Modified 8015) based upon field screening methods indicating potential presence of contamination. Groundwater samples collected from each well were submitted for analysis of TPH by Modified EPA Method 8015. While low levels of TPH (20 to 95 parts per million) were measured in subsurface soil, concentrations were not detected in groundwater samples. The soil and groundwater concentrations did not trigger reporting to Ecology. Location LW-1 was located adjacent to where Blymyer (BEI 1989) had reported elevated hydrocarbons in location B-12, but as mentioned in Section 2.4.1, field collection and analytical methods utilized in Blymyer (BEI 1989) may have overestimated hydrocarbons at that location. The groundwater monitoring wells were decommissioned and are no longer present on the site.

2.4.4 *Pinnacle Geosciences, Inc. (2003)*

A Phase 1 ESA at the T-25S was completed by Pinnacle GeoSciences, Inc., for the Port in September 2003 (Pinnacle Geosciences 2003). Results provide an inventory and overview of potential environmental considerations related to soil and groundwater contamination that could affect future redevelopment of the site. The Phase 1 ESA at T-25S includes summaries of environmental investigations completed at the site through 2003 and identifies "Recognized Environmental Conditions" based on research and results of those investigations. Key historical structures and operations within the T-25S project boundary include the compressor building, vehicle and equipment maintenance building, automobile preparation facility, two sawmills, and a UST (see Figure 3 for the approximate location of key historic features). Possible contamination from historic structures and operations at the site include TPH, solvents (petroleum-based or chlorinated), PCBs, metals, and paint.

2.4.5 *Shannon and Wilson (2008)*

One exploratory soil boring (B-1; Figure 3) was drilled to a depth of 81.5 feet to perform geotechnical engineering analyses regarding the installation of new light poles at T-25S (Shannon and Wilson 2008). While no chemical analysis was conducted on the soil, the subsurface soil conditions summarized in this study will be incorporated into the geotechnical evaluation of the proposed habitat restoration activities. The boring log is included in Appendix C.

2.4.6 *Anchor QEA and Aspect (2012)*

A site investigation was conducted at T-25S to evaluate potential contaminant migration pathways from the upland to the East Waterway OU (Anchor QEA and Aspect 2012). Samples of nearshore groundwater and intertidal bank sediments were collected and analyzed for contaminants of potential concern (COPCs) including metals, SVOCs, PAHs, and PCBs.

Four shallow groundwater wells (AQ-MW-1 to -4) were installed along the nearshore portion of the site to assess the quality of groundwater discharging from the site to the East Waterway (Figure 3). Concentrations of COPCs in groundwater were below the established East Waterway reference values and marine ambient water quality criteria with the exception of acenaphthene and bis(2-ethylhexyl) phthalate in two samples.

Two intertidal bank composite sediment samples were collected (CSS-1 and -2) to assess surface sediment quality in the upper intertidal area of the site (Figure 3). Exceedances of SMS criteria in sample CSS-1 include pentachlorophenol and PAHs, which were attributed to the existing creosote-treated lumber pilings adjacent to the sampling area.

Boring logs for the groundwater well borings are included in Appendix C.

2.5 Existing Sediment Data Summary

Existing sediment characterization results adjacent to T-25S in the East Waterway are summarized in the East Waterway SRI (Windward and Anchor QEA 2014). Limited intertidal samples were collected from the piling field area by hand, but no subtidal surface or subsurface sediment samples within the T-25S boundary because of the safety concerns associated with sampling within the derelict piling field. The fact that additional sampling would occur in this area associated with the design and construction of the habitat project was acknowledged in the SRI. The existing sediment data characterize the shallow main body of the East Waterway, which is distinct from the T-25S vicinity and may not be representative of conditions at T-25S.

2.5.1 *Surface Sediment*

Four surface sediment grab samples were collected in the shallow main body of the East Waterway adjacent to T-25S (EW09-SS-015, EW09-SS-016, EW09-SS018, and EW09-SS020). The phenanthrene concentration in EW09-SS-015 exceeded the Sediment Cleanup Objective (SCO) and there was an SCO exceedance in the bioassay testing for this location. EW09-SS-016 exceeded the SCO for total PCBs. EW09-SS-018 exceeded both the SCO and the cleanup screening level (CSL) for PAHs and EW09-SS-020 exceeded the CSL for mercury.

In addition to the discrete sediment samples, intertidal sediment in this area was characterized as composite samples. Three composite samples in the T-25S area were analyzed for PAHs (EW10-04-

COMP, EW10-05-COMP, and EW10-06-COMP). The PAH concentrations in all three samples were elevated with high-molecular-weight polycyclic aromatic hydrocarbons (HPAH) above the SCO for all three samples with concentrations ranging from 15,100 to 167,000 micrograms per kilogram dry weight (µg/kg dw).

The complete sediment dataset for the surface sediment samples in the vicinity of T-25S is provided in Appendix C.

2.5.2 Subsurface Sediment

Three sediment cores were collected in the vicinity of T-25S for the SRI (EW10-SC06, EW10-SC08 and EW10-SC09). Intervals in all three cores exceeded SMS for mercury and PCBs. In addition, PAH concentrations exceeded SMS in intervals in EW10-SC08 and EW10-SC09. The complete sediment dataset for the subsurface sediment samples in the vicinity of T-25S is provided in Appendix C.

2.6 Project Approach and Schedule

Upland borings and sediment cores will be collected in the winter of 2019. The collected data will inform planning and design for the habitat project in 2019.

3 Project Organization and Responsibilities

This section describes the overall management structure of the project, identifies key personnel, and describes their responsibilities, including field coordination, QA and quality control (QC), laboratory management, and data management. The Port and EPA will be involved in all aspects of this project because of the work in and adjacent to the East Waterway OU of the Harbor Island Superfund site, including the discussion, review, and approval of the QAPP and the interpretation of the results of the investigation.

3.1 Project Organization and Team Member Responsibilities

3.1.1 Project Management

The Port of Seattle will be represented by its project manager (PM), Brick Spangler. Mr. Spangler can be reached as follows:

Mr. Brick Spangler
Port of Seattle
P.O. Box 1209
Seattle, WA 98111
Telephone: 206-787-3193
E-mail: spangler.b@potseattle.org

EPA will be represented by its PM, Ravi Sanga. Mr. Sanga can be reached as follows:

Mr. Ravi Sanga
U.S. Environmental Protection Agency, Region 10
1200 Sixth Avenue, Suite 900
ECL-111
Seattle, WA 98101
Telephone: 206-553-4092
Facsimile: 206-553-0124
E-mail: Sanga.Ravi@epamail.epa.gov

Dan Berlin will serve as the Anchor QEA PM and will be responsible for overall project coordination, providing oversight on planning and coordination, work plans, all project deliverables, and for the performance of the administrative tasks needed to ensure timely and successful completion of the project.

Dan Berlin
Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
Telephone: 206-903-3322
E-mail: dberlin@anchorqea.com

Joy Dunay will serve as the Anchor QEA task manager (TM). The TM is responsible for project planning and coordination, production of work plans, production of project deliverables, and performance of the administrative tasks needed to ensure timely and successful completion of the project. The TM is responsible for communicating with the PM on the progress of project tasks and any deviations from the QAPP. Significant deviations from the QAPP will be further reported to the Port and EPA. Ms. Dunay can be reached as follows:

Joy Dunay
Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
Telephone: 206-903-3320
E-mail: jdunay@anchorqea.com

3.1.2 Field Coordination

Evan Malczyk will serve as the Anchor QEA field coordinator (FC). The FC is responsible for managing the field sampling activities and general field and QA/QC oversight. He will ensure that appropriate protocols for sample collection, preservation, and holding times are observed and will oversee delivery of environmental samples to the designated laboratories for chemical analysis. Mr. Malczyk can be reached as follows:

Evan Malczyk
Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
Telephone: 206-219-5891
E-mail: emalczyk@anchorqea.com

JoDee Taylor, PE, will serve as the Anchor QEA geotechnical engineer and will oversee the collection of geotechnical samples. Ms. Taylor can be reached as follows:

JoDee Taylor, PE
Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101

Telephone: 206-903-3397
E-mail: jtaylor@anchorqea.com

Shawn Hinz (or other qualified personnel) will serve as the boat captain for the vibracorer sampling. The boat captain is responsible for operating the boat and for decisions related to boating operations. The boat captain will work in close coordination with the FC to ensure that samples are collected consistent with the methods and procedures presented in this QAPP.

Shawn Hinz
32617 SE 44th Street
Fall City, WA 98024
Telephone: 425-281-1471
E-mail: shawn@gravitycon.com

Holt Drilling, Inc. (Steve Rasmussen) will serve as the drilling company for upland and intertidal sampling. The driller is responsible for operating the drill rig and collecting sonic boring samples and geotechnical samples. The drilling lead will work in close coordination with the FC and geotechnical engineer to ensure that samples are collected consistent with the methods and procedures presented in this QAPP.

Steve Rasmussen
10621 Todd Road E
Puyallup, WA 98372
Telephone: 253-604-4878
E-mail: srasmussen@holtservicesinc.com

3.1.3 Quality Assurance

Cheronne Oreiro will serve as QA manager and coordinator for chemical analyses for the project. As the QA manager, she will provide oversight for both the field sampling and laboratory programs and will supervise data validation and project QA coordination. Ms. Oreiro can be reached as follows:

Cheronne Oreiro
Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
Telephone: 206-903-3310
E-mail: coreiro@anchorqea.com

The QA/QC manager will ensure that samples are collected and documented appropriately and coordinate with the analytical laboratories to ensure that QAPP requirements are followed.

Laboratory Data Consultants will provide independent third-party review and validation of analytical chemistry data. Christina Rink will act as the data validation PM and can be reached as follows:

Ms. Christina Rink
Laboratory Data Consultants
2701 Loker Avenue West, Suite 220
Carlsbad, CA 92010
Telephone: 760-827-1100, ext. 161
E-mail: crink@lab-data.com

3.1.4 Laboratory Project Management

Analytical Resources, Inc. (ARI) and Analytical Perspectives will perform chemical analyses. Amanda Volgardsen will serve as the laboratory PM for ARI. The laboratory PMs can be reached as follows:

Ms. Amanda Volgardsen
Analytical Resources, Inc.
4611 S 134th Place, Suite 100
Tukwila, WA 98168
Telephone: 206-695-6207
E-mail: amanda.volgardsen@arilabs.com

The laboratory will accomplish the following:

- Adhere to the methods outlined in this QAPP, including those methods referenced for each procedure
- Adhere to documentation, custody, and sample logbook procedures
- Implement QA/QC procedures defined in this QAPP
- Meet all reporting requirements
- Deliver electronic data files as specified in this QAPP
- Meet turnaround times for deliverables as described in this QAPP
- Allow EPA and the QA/QC third-party auditors to perform laboratory and data audits

3.1.5 Data Management

Ms. Ivy Fuller will oversee data management to ensure that analytical data are incorporated into the East Waterway database with appropriate qualifiers following acceptance of the data validation. QA/QC of the database entries will ensure accuracy for use in the habitat restoration project. Ms. Fuller can be reached as follows:

Ms. Ivy Fuller
Anchor QEA, LLC
720 Olive Way, Suite 1900

Seattle, WA 98101
Telephone: 509-293-8733
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3.2 Special Training/Certification

The Superfund Amendments and Reauthorization Act of 1986 required the Secretary of Labor to issue regulations providing health and safety standards and guidelines for workers engaged in hazardous waste operations. The federal regulation 29 Code of Federal Regulations (CFR) 1910.120 requires training to provide employees with the knowledge and skills enabling them to perform their jobs safely and with minimum risk to their personal health. All sampling personnel will have completed the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training course and 8-hour refresher courses, as necessary, to meet the Occupational Safety and Health Administration regulations.

3.3 Documentation and Records

The following sections describe documentation and records needed for field observations and laboratory analyses.

3.3.1 Field Observations

All field activities will be recorded on a daily log maintained by the FC. The daily log will provide a description of all sampling activities, conferences associated with field sampling activities, sampling personnel, and weather conditions, plus a record of all modifications to the procedures and plans identified in this QAPP and the HASP (Appendix A). All entries will be made in indelible ink. The daily log is intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the sampling period.

The following forms, included as Appendix B, will also be used to record pertinent information during core collection and processing:

- Sediment core collection log
- Sediment core processing log
- Upland boring log

3.3.2 Laboratory Records

The laboratory record requirements for the sediment chemistry data are described below. All of the contract laboratories to be used for this investigation are accredited by Ecology.

The chemistry laboratory will be responsible for internal checks on sample handling and analytical data reporting and will correct any errors identified during the QA review. Data packages from the laboratories will be submitted electronically and will include the following:

- **Project narrative:** This summary, in the form of a cover letter, will present any problems encountered during any aspect of analysis. The summary will include, but not be limited to, a discussion of QC, sample shipment, sample storage, and analytical difficulties. Any problems encountered by the laboratory, and their resolutions, will be documented in the project narrative.
- **Records:** Legible copies of the chain-of-custody (COC) forms will be provided as part of the data package. This documentation will include the time of receipt and the condition of each sample received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented.
- **Sample results:** The data package will summarize the results for each sample analyzed. The summary will include the following information, as applicable:
  - Field sample identification (ID) code and the corresponding laboratory ID code
  - Sample matrix
  - Date of sample extraction/digestion
  - Date and time of analysis
  - Weight and/or volume used for analysis
  - Final dilution volumes or concentration factor for the sample
  - Percent moisture in the samples
  - Identification of the instruments used for analysis
  - Method detection limits (MDLs) and quantitation limits (QLs)
  - All data qualifiers and their definitions
- **QA/QC summaries:** These summaries will contain the results of all QA/QC procedures. Each QA/QC sample analysis will be documented with the same information as that required for the sample results (see above). The laboratory will make no recovery or blank corrections. The required summaries are listed below.
  - The calibration data summary will contain the concentrations of the initial calibration and daily calibration standards and the date and time of analysis. The response factor, percent relative standard deviation (%RSD), relative percent differences (RPDs), and retention time for each analyte will be listed, as appropriate. Results for standards analyzed at the QL to determine instrument sensitivity will be reported.
  - The internal standard area summary will report the internal standard areas, as appropriate.

  - The method blank analysis summary will report the method blank analysis associated with each sample and the concentrations of all compounds of interest identified in these blanks.
  - The surrogate spike recovery summary will report all surrogate spike recovery data for organic analyses. The names and concentrations of all compounds added, percent recoveries, and QC limits will be listed.
  - The matrix spike (MS) recovery summary will report the MS or MS duplicate (MSD) recovery data for analyses, as appropriate. The names and concentrations of all compounds added, percent recoveries, and QC limits will be included in the data package. The RPD for all MS/MSD analyses will be reported.
  - The laboratory replicate summary will report the RPD for all laboratory replicate analyses. The QC limits for each compound or analyte will be listed.
  - The standard reference material (SRM) analysis summary will report the results and recoveries of the SRM analyses and list the accuracy for each analyte, when available.
  - The laboratory control sample (LCS) analysis summary will report the results of the analyses of the LCS. The QC limits for each compound or analyte will be included in the data package.
  - The relative retention time summary will report the relative retention times for the primary and confirmational columns of each analyte detected in the samples, as appropriate.
- **Original data:** Legible copies of the original data generated by the laboratory will be provided, including the following:
  - Sample preparation, extraction/digestion, and cleanup logs
  - Instrument analysis logs for all instruments used on days of calibration and analysis
  - Chromatograms for all samples, blanks, calibration standards, MS/MSD, laboratory replicate samples, LCS, and SRM samples for all gas chromatography analyses
  - Reconstructed ion chromatograms of target chemicals detected in the field samples and method blanks for all gas chromatography/mass spectrometry (GC/MS) analyses
  - Enhanced and unenhanced spectra of target chemicals detected in field samples and method blanks, with associated best-match spectra and background-subtracted spectra, for all GC/MS analyses
  - Quantitation reports for each instrument used, including reports for all samples, blanks, calibrations, MS/MSD, laboratory replicates, LCS, and SRMs

The contract laboratories for this project will submit data electronically in EarthSoft EQuIS® four-file format. Additional electronic data deliverable information will be communicated to the laboratories by the project QA/QC coordinator or data manager. All electronic data submittals must be tab-

delimited text files with all results, MDLs, and QLs reported to the appropriate number of significant figures.

3.3.3 Data Reduction

Data reduction is the process by which original data are converted or reduced to a specified format or unit to facilitate the analysis of the data. For example, a final analytical concentration may need to be calculated from a diluted sample result. Data reduction requires that all aspects of sample preparation that could affect the test result, such as sample volume analyzed or dilutions required, be taken into account in the final result. It is the laboratory analyst's responsibility to reduce the data, which are subjected to further review by the laboratory PM, the project QA/QC coordinator, and independent reviewers. The data will be generated in a form amenable to review and evaluation. Data reduction may be performed manually or electronically. If performed electronically, all software used must be demonstrated to be true and free from unacceptable error.

During chemical analysis, samples are occasionally diluted after the initial analysis if the estimated concentration curve for one or more of the target analytes is above the calibration curve. In these instances, concentrations from the initial analysis will be identified as the "best result" for all target analytes other than the chemical(s) that was originally above the calibration range. The "best result" for this qualified analyte(s) will be taken from the diluted sample.

3.3.4 Data Report

A data report will be prepared documenting all activities associated with the collection, handling, and analysis of samples. At a minimum, the following will be included in the data reports:

- Summary of all field activities, including descriptions of any deviations from the approved QAPP
- Copies of field forms
- Summary spreadsheet containing information from field forms
- Sampling locations reported in latitude and longitude to the nearest one-tenth of a second and in northing and easting to the nearest foot
- Plan view of the project showing the actual sampling locations
- Summary of the QA/QC review of the analytical data
- Data validation reports (appendices)
- Results from the analysis of field samples (including field QC samples), both as summary tables in the main body of the report and appendices with data forms submitted by the laboratories and as crosstab tables produced from the project database

Analytical data will be validated within 4 weeks of the receipt of data packages from the laboratories. A draft data report will be submitted to EPA approximately 4 weeks after data validation is complete.

A geotechnical evaluation may be provided in a separate deliverable at a later date. Once the data report has been approved by EPA, the data will be uploaded to Ecology's Environmental Information Management System.

4 Data Generation and Acquisition

This section describes the collection and handling of sediment samples for chemical analyses. Elements include sampling design; sampling methods; sample handling and custody requirements; analytical methods; QA/QC, instrument/equipment testing and frequency, inspection and maintenance; instrument calibration; supply inspection/acceptance; and data management.

4.1 Sampling Design

The sampling design was developed to meet the project objectives presented in Section 2.1. The preliminary design for the habitat restoration was used to select the upland and sediment sampling depths. Figure 2 shows the existing upland topography and sediment bathymetry of T-25S. The existing OHWM denotes the upland boundary of the East Waterway OU of the Harbor Island Superfund Site. Figure 4 shows the proposed sample locations and the project elevation changes (existing relative to proposed subgrade) based on the preliminary design that is not shifted to account for the potential Sound Transit light rail lines. Material above the proposed subgrade elevation represents the material that will be excavated as part of the restoration project. The proposed grade refers to the final restoration elevation following excavation and backfill of suitable habitat substrate. Cross sections depicting existing, proposed grade, and proposed subgrade elevations are shown in Figures 5a and 5b. Proposed and historical sampling locations along or adjacent to these cross sections are projected at their relative locations and depths for reference. The cross sections also include the approximate elevation of the top of wood debris observed in historical subsurface explorations (see Section 4.1.1 and Appendix C).

4.1.1 Upland Borings

Locations of upland borings were selected to provide spatial representativeness in areas that have not previously been sampled and/or are within areas with potential historical contamination based on historical uses. Upland sampling will consist of borings at 15 locations, including 10 locations within the current proposed design footprint and an additional 5 locations in the area where the stormwater pond will be located or where the restoration may be expanded because of the project shift from the Sound Transit light rail lines (Figure 3). Three locations are within the intertidal area adjacent to the existing piling field. Eleven borings will be advanced 20 feet bgs and sampled for disposal characterization (to excavation elevations) and site COPCs below excavation elevations. Three borings will be advanced 25 feet bgs and sampled for disposal characterization (to excavation elevations), site COPCs below excavation elevations (to 20 feet), and geotechnical parameters (to 25 feet). One boring will be advanced to 75 feet bgs and sampled for disposal characterization (to excavation elevation), site COPCs below excavation elevations (to 20 feet), and geotechnical parameters (to 75 feet). Table 1 provides the sampling design for the upland sampling program,

which includes the sample depth intervals, coordinates, sample test parameters, and rationale for each location.

The material in the excavation interval will be composited into one sample per boring and submitted to the laboratory for disposal characterization parameters. The 2-foot depth below the subgrade elevation represents the post-excavation surface interval. A 2-foot interval was selected to be consistent with the subsurface characterization for the East Waterway RI, to align with the Dredged Material Management Program (DMMP) definition of the Z-layer, and to provide enough material to analyze the full suite of SMS parameters plus dioxin/furans. Consecutive 2-foot intervals will be collected to the bottom of the boring for testing or archive (see Table 1). Select locations will also include geotechnical samples at discrete intervals. Section 4.2.1 provides more details on the sampling methods and requirements for the upland boring program.

Wood debris was encountered at depth (greater than 10 feet bgs) in many of the historical borings (Appendix C) likely due to fill placement. The approximate depth of wood debris is depicted in the cross sections (Figures 5a and 5b). Wood debris layers encountered during sampling activities will be noted on the boring log. Sampling intervals may be modified in these instances.

4.1.2 Sediment Cores

Sediment core locations were selected to characterize the sediment characteristics throughout the sediment slope adjacent to T-25S and to characterize the sediment that will be dredged during construction of the restoration project. Table 2 provides the sampling design for the sediment cores, which includes the depth, coordinates, sample test parameters, and rationale for each location.

The preliminary design for the restoration project was used to identify the locations where sediment will be dredged. Cores SC-01 through SC-04 were placed within the piling field, in areas where dredging will be required. Core SC-05 is located within an area where dredging will be required outside the piling fields. In addition, cores SC-06 through SC-09 were placed at the perimeter of the piling field to provide spatial coverage.

Within anticipated dredge areas, the material in the preliminary design dredge removal interval (existing elevation relative to proposed subgrade elevation) at locations SC-01 through SC-05 will be sampled and composited into one sample per core and submitted to the laboratory for disposal characterization. The 1-foot depth below the subgrade elevation represents the post-dredge surface interval and will be analyzed for SMS parameters and dioxins and furans. Additional 1-foot intervals will be collected below the post-dredge surface until the bottom of the core and archived.

Cores SC-06 through SC-09 will be sectioned into 1-foot intervals, with the 0- to 1-foot interval (surface interval) from each core analyzed for SMS parameters and dioxins and furans. Additional 1-foot intervals will be collected until the bottom of the core and archived. These samples will be

analyzed if there are SMS exceedances in the post-dredge surface interval to provide a vertical profile of the contaminants that exceed SMS. Section 4.2.2 provides more details on the sampling methods and requirements for the subsurface sediment samples.

Subsurface cores will target the associated design elevations and will be collected to the maximum possible depth below mudline. Vibracoring may encounter difficult conditions including the instability of the pilings, water depth at the location (vibracorer on remote floating platform), and core refusal due to coarse debris and shoreline armoring. Any corrections based on core recovery will be discussed with EPA prior to the adjustment of sampling intervals.

Historical sediment core logs including summary analytical tables from sampling locations adjacent to T-25S from the East Waterway SRI (Windward and Anchor QEA 2014) are included in Appendix C.

4.2 Sampling Methods

This section describes sampling methods and includes sample identification, station positioning, upland soil and sediment collection and processing, decontamination procedures, and waste disposal. Soil samples will be obtained using sonic boring collection methods. Sediment samples will be obtained using vibracore collection methods.

4.2.1 Upland Soil and Intertidal Bank Borings

Upland borings will be collected using a track-mounted sonic drill rig with a 5- or 6-inch-diameter 5-foot length steel core barrel. Sonic drilling is proposed for this study due to the need to drill through fill material that may contain debris from former structures and operations. A small amount of sample disturbance is inherent to sonic drilling methods when material is extruded from the core barrel into plastic liners using vibration. Sample intervals will be selected at no less than 1-foot increments to maintain precision from potential disturbance during collection.

The 5-foot core barrel will be rinsed clean of soil and decontaminated before each use, including between stations, to eliminate the possibility of cross-contamination. A steel catcher (drill shoe) may be used, if necessary, to retain the soil. The core barrel (with drill shoe as needed) will be attached to the drill rod, and the cutting head will be attached to the core barrel. The drill will be deployed from the rig and lowered down to the soil surface.

The core barrel will be sonically-driven into the soil to the targeted depth and retrieved upon either full penetration of the core tube segment, penetration to specified elevations, or at refusal. The depth of core penetration will be measured and recorded, along with conditions and/or obstructions observed during drilling (e.g., difficult drilling conditions). As part of core retrieval, a casing will be advanced over the core barrel before the core barrel is extracted from the cased hole. The cutting bit (and core catcher, if used) will be removed by the drilling operator. Soil within the core tube will be

extruded out of the core barrel and into a disposable plastic liner (sleeve) using a low-frequency sonic vibration (i.e., to minimize sample disturbance). Before proceeding with the next sample interval, a measurement will be taken in the cased sample hole to determine if heaving sands have reoccupied the casing, and to verify the top depth and elevation of the next sample interval. If heaving sands are encountered and the casing is occupied by heave, the driller may not blow out this material using water or any other type of pressurized method but must instead determine the length of the core tube that has been reoccupied and collect that material first before proceeding with the next sampling interval. Water pressure may be maintained in the cased hole prior to and during core extraction to minimize heaving sands from occupying the casing.

Acceptance criteria for upland boring samples are as follows:

- The core segment appears intact without obstruction or blocking.
- The core was advanced to the target depth.
- The material in the core supports design objectives (recovery meets elevation targets).

If sample acceptance criteria are not achieved, the sample is rejected unless modified acceptance criteria are approved by the FC and/or multiple attempts have been made at the sampling location. Substantial buried debris exists at T-25S from former structures and operations and are likely to result in poor recovery for some depth intervals. Poor recovery due to buried debris at the site may result in the adjustment of sample intervals to achieve adequate sample volume while still meeting DQOs. These situations will be evaluated on a case-by-case basis by the FC.

Geotechnical standard penetration tests (SPT) will be conducted at three boring locations at subsurface soil intervals identified in Table 1. Two sample locations will be advanced to a depth of 25 feet bgs and one location will be advanced to 75 feet bgs for the purposes of characterizing geotechnical parameters relevant to the habitat restoration at T-25S. While sample intervals will be given priority for chemistry sampling, SPT tests will be conducted approximately every 5 feet in each boring. SPT tests will not be conducted in the 4-foot layer below the proposed excavation cut to prioritize sample volume for post-excavation surface chemical characterization. After advancing the sonic core barrel (and retrieving the soil for chemistry sampling) to the desired elevation bgs, a 2- or 3-inch outside-diameter, decontaminated split spoon will be advanced into the soil using a 140-pound hammer dropped 18 inches. After retrieving the split spoon sampler, sonic coring for the collection of chemistry parameters will continue until the next SPT interval.

Temporary boreholes will be decommissioned in accordance with state regulations (Chapter 173-160 of the Washington Administrative Code [WAC]). Each borehole will be abandoned by backfilling with bentonite chips.

4.2.1.1 Upland Sample Processing

Upland boring samples will be processed adjacent to the station location. For chemical analyses, the plastic liner for each sampling interval will then be cut lengthwise and opened for processing. Each boring will be continuously examined to develop a lithologic boring log and will be photographed. Physical characteristics of each core will be noted on a soil boring form (Appendix B) and will include color, structure, texture, mineral composition, moisture, and recovery, in accordance with American Society for Testing and Materials International (ASTM) D2488. Field screening will include photoionization detector (PID) monitoring of all sampling intervals.

Additionally, the following parameters will be noted:

- Sample recovery
- Odor (e.g., hydrogen sulfide or petroleum)
- Visual stratification, structure, and texture
- Vegetation and debris (e.g., wood chips or fibers, concrete, or metal debris)
- Biological activity (e.g., detritus, shells, tubes, bioturbation, or live or dead organisms)
- Presence of oil sheen

All samples will be collected using decontaminated stainless steel spoons and bowls. Discrete samples will be collected from specified depth intervals, as outlined in Table 1 and spooned into a clean stainless steel bowl for homogenization. The soil will be mixed until homogeneous in color and texture and then spooned into laboratory-supplied jars for testing. The analytical testing scheme for soil samples is presented in Table 1 and associated handling and storage guidelines in Table 3.

Soil and sediment borings will include analysis for site COPCs and physical analyses as summarized below.

- Excavated soil disposal characterization
  - Total solids
  - Toxicity characteristic leaching procedure (TCLP) metals
  - Total petroleum hydrocarbons (diesel and residual range)
  - Total PCB Aroclors
  - Polycyclic aromatic hydrocarbons
  - Semivolatile organic compounds
  - Aliquot of excess sample volume archived for potential additional analyses
- Sample intervals below excavation depth
  - Total solids
  - Total organic carbon
  - SMS metals
  - Total PCB Aroclors

  - Polycyclic aromatic hydrocarbons
  - Semivolatile organic compounds
  - Dioxin/furans
  - Aliquot of excess sample volume archived for potential additional analyses
- Geotechnical intervals
  - Grain size, moisture content, Atterberg limits, and bulk density will be collected at various SPT intervals at the discretion of field staff.
  - Excess soil volume collected from SPT split spoon samples may be archived for potential additional chemical analyses.

4.2.2 Sediment Coring

This section describes the methods for collecting and processing subsurface sediment cores. Sediment sampling will be conducted at locations shown in Figure 2. All field activities will be performed under the direction of the FC, with EPA oversight as appropriate. The field geologist will lead activities associated with the logging and processing of sediment cores. There may be contingencies during field activities that require modification of the general procedures outlined below. Procedures may be modified at the discretion of the FC after consultation with the PM and the boat operators, if applicable. EPA will be consulted if significant deviations from the sampling design are required (e.g., repositioning of a location, as discussed in Section 4.2.5). All modifications will be recorded in the field logbook and on a protocol modification form (Appendix B).

4.2.2.1 Subsurface Sediment Core Collection

Sediment cores will be collected to targeted depths ranging from 6 to 12 feet below mudline (depending upon the location) and driven until refusal. Cores will be collected with a vibracorer. The vibracorer will be deployed by two methods. For cores T25-SC01 through SC05, the vibracorer will be deployed on a remote floating platform in order to navigate within the pilings. Cores T25-SC06 through T25-SC09 will be collected using a vessel-mounted vibracorer.

The vibracorer consists of a vibrating power head attached to a 6 to 8-foot-long floating platform (depending on water elevation) or 12-foot-long vessel-mounted, 3.75-inch-diameter core barrel. Once the sampling platform/vessel is positioned at the target sampling location, the vibracorer and a decontaminated core tube is lowered using a hydraulic winch. The core is penetrated to the targeted depth or until refusal, and then pulled up using the winch. Once on board the vessel, the depth of core penetration is measured and recorded (i.e., the total core length minus the void space within the core). The following data will be recorded on the sediment core collection log (Appendix B):

- Sampling location, time, tide, and depth of water to sediment (as measured by leadline)
- Elevation of location as estimated from MLLW using tide tables
- Location coordinates from differential global positioning system (DGPS)

- Names of field personnel collecting and handling the cores
- Observations made during core collection, including weather conditions, complications, ship traffic, and other details associated with the sampling effort
- Physical description of core tube (e.g., intact, bent, full core-catcher)
- Length and depth intervals of each core section and estimated recovery for each sediment sample as measured from MLLW
- Qualitative notation of apparent resistance of sediment column to coring (how the core drove)
- Any deviation from the approved QAPP

4.2.2.2 On-Deck Core Processing

The sediment core tubes will be inspected for adherence to the following criteria:[1]

- Core was collected to the targeted depth below mudline.
- Core tube is not overfilled.
- Overlying water is present and the surface interval is intact.
- Estimated recovery is greater than 75%, and the core tube appears intact without obstructions or blocking.

If sample acceptance criteria are not achieved in the first core at a sampling location, the sample will be set aside and up to two additional core drives will be advanced at locations within 10 meters of the targeted location. If sample acceptance criteria are not achieved in any of the three cores, oversight personnel will be consulted to discuss whether an alternative location should be sampled. The sampling location may be repositioned at a location greater than 10 meters from the targeted location, following discussions with EPA and Port representatives. If an alternative location is not selected, the core with the greatest sampling depth and recovery will be used.

While the core tube is on deck, the overlying water will be siphoned off, if necessary, using plastic tubing or a similar siphoning device. The vibracore tubes will be cut off near the sediment surface. Cores collected using the vibracorer will be cut into 5-foot sections so they can be transported to the laboratory in a vertical position, if possible, and so they will fit in the refrigeration units at the laboratory until processing. The intact core or core sections will be capped, taped, and labeled with the station ID and "top" and "bottom." The vibracore tubes will be reconstructed during core processing by lining up the labeled sections as appropriate. Core tubes will be sealed to minimize loss of moisture and transported to ARI for subsequent processing, sampling, and logging.

[1] An additional criterion is that the core reaches native sediment, which will be determined after the core is opened.

4.2.2.3 Subsurface Sediment Core Processing

Core tubes will be handled and processed at ARI by Windward and Anchor QEA as soon as possible after they are received. Cores will be handled in a manner consistent with ASTM procedures (ASTM D 4220). Cores that are not processed on the day of collection will be stored upright (if possible) in the ARI refrigerators (i.e., vibracores). Cores may be held for a maximum of 72 hours before processing. Core processing will involve three basic steps: 1) core cutting; 2) observation and logging; and 3) sampling. The field geologist will oversee the sediment core processing activities.

Sediment from the vibracorer will be cut for logging and sampling by removing the core caps and cutting the core tube longitudinally with a circular saw. The core will be split into two halves with decontaminated stainless steel wire core splitters or spatulas. If the core was divided into sections for easier transport, this step will be repeated for each section until the entire core is extracted.

The profile of the accepted core for each location will be visually logged for major and minor contacts (i.e., regions in the core where sediment characteristics noticeably change), as described below. A portable PID will be used to determine the potential presence of VOCs in the core. Photographs of each core will be taken before sampling. The core will be logged by a field geologist or geotechnician and recorded on the sediment core processing log (presented in Appendix B).

Below the dredge material disposal characterization elevation, each core will be sub-sectioned into 1-foot sampling intervals according to the sampling design discussed in Section 4.1 and Table 2, unless a major stratigraphic boundary is present. If a major difference in stratigraphic units is observed, the sample will not be collected at the fixed 1-foot interval, but will instead include only sediments within the same stratigraphic unit (if adequate sample volume). Chemical releases to sediment may have been associated with different historical periods as indicated by the sediment stratigraphy, so it is desirable to separate the chemical analyses for the different units. Two additional samples will be collected for additional geotechnical parameters (grain size, Atterberg limits, bulk density, moisture content) within discrete lithological intervals from select core locations depending on the types of lithology encountered.

The sectioning decision for each core will be made by the field geologist, in consultation with EPA oversight if present at the time the core is sectioned. Sediment descriptions and the interpreted *in situ* depths of each sediment horizon (derived from calculations on the bore log) will be recorded on the sediment core processing log (Appendix B). Data recorded on the core processing logs will include the following:

- Sample recovery
- Physical soil description in accordance with ASTM procedures (ASTM D 2488 and ASTM D 2487 – Unified Soil Classification System) including soil type, density/consistency of soil, and color
- Odor (e.g., hydrogen sulfide, petroleum)

- Visual stratification, structure, and texture
- Vegetation and debris (e.g., woodchips or fibers, paint chips, concrete, sand blast grit, metal debris
- Biological activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
- Presence of oil sheen
- PID results for potential presence of VOCs

After a core is logged, sediment from designated sampling intervals in that core will be spooned into stainless steel bowls, homogenized until uniform in color and texture, and placed into pre-cleaned, labeled glass jars for chemical analyses, as specified in Section 4.3.1. Care will be taken not to include sediment that has been in contact with the core sidewalls or caps. Organisms and debris will be removed prior to distribution to sample containers; removed materials will be noted in the field logbooks. All sample containers will be labeled on the outside in indelible ink with the sample ID number, date collected, and analysis to be performed.

Each subsurface sediment sample identified for dredge material disposal characterization will be analyzed for total solids, TCLP metals, PCB Aroclors, PAHs, and SVOCs; an aliquot of excess sample volume from each core will be archived for potential additional analyses. Each subsurface sediment sample identified for chemical analyses (except archived samples) will be analyzed for SMS chemicals (SVOCs, PCB Aroclors, mercury, and other metals) and dioxins and furans using analytical methods presented in Section 4.4. Each subsurface sediment sample (except archived samples) identified for chemical analyses will also be analyzed for total organic carbon (TOC), total solids, and grain size. Additional discrete samples collected for geotechnical parameters may be analyzed for grain size, Atterberg limits, moisture content, and bulk density at the discretion of field staff.

4.2.3 Identification Scheme for all Locations and Samples

Each subsurface sediment core sampling location will be assigned a unique alphanumeric location ID number according to the following method:

- The first four characters of the location ID are "T25" to identify the T-25S project area.
- The next four characters are SC (sediment core) or SB (soil boring) to indicate the type of samples to be collected, followed by a consecutive number identifying the specific location (e.g., SC-01, SB-11).
- The sample ID will consist of the location ID followed by a numerical suffix that indicates which depth horizon the sample came from (i.e., 2-4).
- Example sample nomenclature include:
  - T25-SC01-0-3.4: Subsurface sediment sample collected at a depth interval from 0 to 3.4 feet below mudline at location SC-01

  - T25-SB11-11.5-13.5: Upland boring sample collected at a depth interval of 11.5 to 13.5 feet below ground surface at location SB-11
- A field duplicate collected from a sample will be identified by the addition of '50' to the sample number. A duplicate sample of the above subsurface sediment example would be T25-SC51-0-3.4.

Rinsate blank samples will use the overall site identifier followed by "RB" and the collection method. The resulting nomenclature of a rinsate blank for subsurface sediment and upland soil processing would be T25-RB-SC and T25-RB-SB, respectively.

4.2.4 Location Positioning – Upland Boring Locations

Horizontal positioning will be determined in the field by a DGPS based on target coordinates. The horizontal datum will be North American Datum of 1983 (NAD83), Washington State Plane North. Measured geographical coordinates for station positions will be recorded and reported to the nearest 0.01 second. In addition, state plane coordinates will be reported to the nearest foot. The DGPS accuracy is less than 1 meter and generally less than 30 cm, depending on the satellite coverage and the number of data points collected. Anchor QEA may photograph the locations to aid in understanding the sample location.

4.2.5 Location Positioning – Sediment Coring Locations

Target sampling locations will be located using a Trimble NT300D DGPS. The DGPS includes a global positioning system (GPS) receiver unit onboard the sampling vessel and a U.S. Coast Guard (USCG) beacon differential receiver. The GPS unit will receive radio broadcasts of GPS signals from satellites. The USCG beacon receiver will acquire corrections to the GPS signals to produce positioning accuracy to within 1 to 2 meters.

Northing and easting coordinates of the vessel will be updated every second and displayed directly on a computer onboard the vessel. The coordinates will then be processed in real time and stored at the time of sampling using the positioning data management software package. NAD83, Washington State Plane North, will be used for the horizontal datum. The vertical datum will be obtained by measuring the depth from the water surface to the mudline at each sampling location using a leadline. This depth will be corrected for tidal influence after sampling has been completed to obtain the depth of the mudline relative to MLLW. Tidal elevation will be determined by calling the National Ocean Service for data from their automated tide gage located at Pier 54.

To ensure the accuracy of the navigation system, a checkpoint will be located at a known point such as a pier face, dock, piling, or similar structure that is accessible by the sampling vessel. At the beginning and end of each day, the vessel will be stationed at the check point, a GPS position reading will be taken, and the reading will be compared with the known land-survey coordinates. The

two position readings should agree, within the limits of survey vessel operational mobility, to within 1 to 2 meters.

4.2.6 *Decontamination Procedures*

All sediment and soil processing and homogenizing equipment used during sampling (i.e., stainless steel plates, spatulas, bowls, and spoons), will be decontaminated between sampling locations following Puget Sound Estuary Program (PSEP) guidelines (1997) and the following procedures:

1. Pre-wash rinse with tap water or site water.
2. Wash and scrub equipment with a solution of tap water and phosphate-free detergent (Alconox or similar).
3. Rinse with tap water.
4. Rinse three times with distilled water.
5. Cover (no contact) all decontaminated items with aluminum foil.
6. Store in a clean, closed container, for bowls, store inverted on a foil-covered surface for next use.

Any sampling equipment that cannot be cleaned to the satisfaction of the FC and EPA (if present) will not be used for further sampling activities.

4.2.7 *Waste Disposal*

All disposable sampling materials and personal protective equipment used during sample collection in the field, such as disposable coveralls, gloves, and paper towels, will be placed in heavyweight garbage bags or other appropriate containers. Disposable supplies will be removed from the site by sampling personnel and placed in a normal refuse container for disposal as solid waste. Excess sediment/soil remaining after processing will be placed in 55-gallon drums and stored at a secure location. Drums will be properly labeled, kept closed, and stored separately from other incompatible wastes (e.g., liquid solvents). A composite sample of investigative-derived waste will be collected and chemically analyzed to obtain representative data for disposal profiling.

4.3 Sample Handling and Custody Requirements

This section describes how individual samples will be processed, labeled, tracked, stored, and transported to the laboratory for analysis. In addition, this section describes sample custody procedures and shipping requirements. Sample custody is a critical aspect of environmental investigation. Sample possession and handling must be traceable from the time of sample collection through laboratory analyses until Windward or Anchor QEA authorizes sample disposal.

4.3.1 Sample Handling Procedures

Samples for chemical analyses will be placed in appropriately sized, pre-cleaned, labeled, wide-mouth glass jars and capped with Teflon®-lined lids (Table 3). All sample containers will be filled leaving a minimum of 1 cm of headspace to prevent breakage during transport and storage.

Sample labels will be waterproof and self-adhering. Each sample label will contain the project name, sample ID, preservation technique, type of analysis, date and time of collection, and initials of the person(s) preparing the sample. A completed sample label will be affixed to each sample container. The labels will be covered with clear tape immediately after they have been completed to protect them from being stained or spoiled from water, sediment, or soil.

4.3.2 Sample Custody Procedures

Samples are considered to be in custody if they are: 1) in the custodian's possession or view; 2) retained in a secured place (under lock) with restricted access; or 3) placed in a container and secured with an official seal(s) such that the sample cannot be reached without breaking the seal(s). Custody procedures will be used for all cores and samples throughout the collection, transport, and analytical process. Custody procedures will be initiated during sediment core collection. COC forms will accompany sediment cores when they are delivered by the field crew to the processing area (on site or at ARI), and separate forms will then accompany the processed samples during transfer to ARI personnel at the laboratory. Each person who has custody of the cores or samples will sign the COC form and ensure that the cores or samples are not left unattended unless properly secured. Minimum documentation of core or sample handling and custody will include the following:

- Project name and unique core or sample number
- Core or sample collection date and time
- Any special notations on core or sample characteristics or problems
- Initials of the individual collecting the core or sample
- Date core or sample was sent to the laboratory
- Shipping company name and waybill number, if applicable

The FC will be responsible for all sample tracking and custody procedures for sediment cores in the field. The FC will be responsible for final sample inventory and will maintain sample custody documentation. At the end of each day, and prior to transfer of sediment cores and/or sediment samples to the laboratory, COC entries will be made for all cores and samples. Information on the labels will be checked against sample log entries, and sample tracking forms and samples will be recounted. COC forms will accompany all cores and samples. The COC forms for the sediment cores will be signed at the point of transfer from the field to the laboratory, and the COC forms for the sediment samples will be signed at the point of transfer from Windward and Anchor QEA personnel to ARI personnel. Copies of all COC forms will be retained and included as appendices to QA/QC

reports and data reports. After sediment core processing, the sediment samples will be hand-delivered to ARI. The FC will ensure that the laboratory has accepted delivery of the shipment at the specified time.

The laboratories will ensure that COC forms are properly signed upon receipt of the samples and will note questions or observations concerning sample integrity on the COC forms. The laboratories will contact the FC or the project QA/QC coordinator immediately if discrepancies between the COC forms and the sample shipment upon receipt are discovered.

At each laboratory, a unique sample identifier will be assigned to each sample. The laboratory will ensure that a sample tracking record follows each sample through all stages of laboratory processing. The sample tracking record must contain, at a minimum, the name/initials of individuals responsible for performing the analyses, dates of sample extraction/preparation and analysis, and the type of analysis being performed. The laboratories will not dispose of the environmental samples for this project until notified in writing by the project QA/QC coordinator.

4.3.3 Sample Transport and Storage

Sample processing of upland boring locations will be conducted on site. Sample processing of subsurface sediment cores will be conducted on site or at ARI. Samples will be packed securely in bubble wrap and stored on ice or refrigerated until they are directly transferred to the custody of ARI. The temperature inside the cooler(s) containing sediment samples will be checked upon receipt at the laboratory by either measuring the temperature of blank water samples packed inside the cooler, or using an infrared device. The laboratory will specifically note if the cooler is not sufficiently cold (4° ± 2°C) upon receipt.

4.4 Analytical Methods and Data Quality Indicators

This section discusses the analytical methods that will be used to characterize samples and the data quality indicators (DQIs) for each chemical analysis.

4.4.1 Analytical Methods

ARI, a National Environmental Laboratory Accreditation Program accredited laboratory, will conduct physical and chemical testing. Table 4 presents the proposed analytes, evaluation criteria, analytical methods to be used, and target quantitation limits for the evaluation of soil and sediment. All sample analyses will be conducted in accordance with PSEP- and Ecology-approved methods. Prior to analyses, all samples will be maintained according to appropriate holding times and temperatures for each analysis (Table 3).

4.4.2 *Data Quality Indicators*

The parameters used to assess data quality are precision, accuracy, representativeness, comparability, completeness, and sensitivity. Table 5 lists specific DQIs for the laboratory analyses of all samples. These parameters are discussed in greater detail in the following sections.

4.4.2.1 Precision

Precision is the measure of the reproducibility among individual measurements of the same property, usually under similar conditions, such as multiple measurements of the same sample. Precision is assessed by performing multiple analyses on a sample and is expressed as an RPD when duplicate analyses are performed and as %RSD when more than two analyses are performed on the same sample (e.g., triplicates). Precision is assessed through laboratory duplicate analyses (i.e., laboratory replicate samples, MS/MSD, LCS duplicates) for all parameters except when reference materials are not available or spiking of the matrix is inappropriate. In these cases, precision is assessed through laboratory triplicate analyses. Precision measurements can be affected by the nearness of a chemical concentration to the MDL, where the percent error (expressed as either %RSD or RPD) increases. The DQI for precision varies depending on the analyte (Table 5). The equations used to express precision are as follows:

Equation 1

$$RPD = \frac{(\text{measured conc} - \text{measured duplicate conc})}{(\text{measured conc} + \text{measured duplicate conc}) \div 2} \times 100$$

$$\%RSD = (SD/D_{ave}) \times 100$$

where:

$$SD = \sqrt{\left(\frac{\left(\sum Dn - D_{ave}\right)^2}{(n-1)}\right)}$$

D	=	sample concentration
D_{ave}	=	average sample concentration
n	=	number of samples
SD	=	standard deviation

4.4.2.2 Accuracy

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Accuracy may be expressed as a percentage recovery for MS, LCS, and ongoing precision and

accuracy sample analyses. The DQI for accuracy varies, depending on the analyte (Table 5). The equation used to express accuracy for spiked samples is as follows:

Equation 2

$$\text{Percent recovery} = \frac{\text{spike sample result} - \text{unspiked sample result}}{\text{amount of spike added}} \times 100$$

4.4.2.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent an environmental condition. The sampling approach was designed to address the specific objectives described in Section 2.1. Assuming those objectives are met, the samples collected should be considered adequately representative of the environmental conditions they are intended to characterize.

4.4.2.4 Comparability

Comparability expresses the confidence with which one dataset can be evaluated in relation to another dataset. Sample collection and chemical and physical testing will adhere to the most recent PSEP QA/QC procedures (PSEP 1997) and EPA and PSEP analysis protocols.

4.4.2.5 Completeness

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

Equation 3

$$\text{Completeness} = \frac{\text{number of valid measurements}}{\text{total number of data points planned}} \times 100$$

The DQI for completeness for all components of this project is 95%. Data that have been qualified as estimated because the QC criteria have not been met will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness.

4.4.2.6 Sensitivity

Analytical sensitivity is a measure of both the ability of the analytical method to detect the analyte and the concentration that can be reliably quantified. The minimum concentration of the analyte that can be detected is the MDL. The minimum concentration that can be reliably quantified is the QL. Laboratories use both MDLs and QLs for reporting analyte concentrations, and both values will be used as measures of sensitivity for each analysis.

The MDL is defined as the lowest concentration of an analyte or compound that a method can detect in either a sample or a blank with 99% confidence. ARI determines MDLs using standard procedures outlined in 40 CFR 136, in which seven or more replicate samples are fortified at 1 to 5 times (but not to exceed 10 times) the expected MDL concentration. The MDL is then determined by calculating the standard deviation of the replicates and multiplying by the Student's t-factor (e.g., 3.14 for seven replicates).

QLs are equal to or greater than the lower calibration limit defined by the lowest concentration on the calibration curve. QLs, MDLs, and estimated detection limits are adjusted for each sample based on the amount of sample extracted, dilution factors, and percent moisture.

All laboratories will report detected concentrations above the QL without qualification and will report detected concentrations between the MDL (ARI) or estimated detection limit (for dioxins/furans analysis) and the QL with a J-qualifier indicating the concentration is an estimated value. The estimated detection limit for dioxin/furans analysis is a sample-specific detection limit based on the signal to noise ratio at the time of sampling. Non-detect results will be reported to the QL with a U-qualifier.

4.5 Quality Assurance/Quality Control

The QA/QC criteria for the field and laboratory analyses are described below. Table 6 summarizes field and laboratory QA/QC types and frequencies for each analyte.

4.5.1 Field QC Samples

Field duplicate samples will be collected to evaluate the variability attributable to sample homogenization and subsequent sample handling. Field duplicate samples will be collected from the same homogenized material as the original sample and analyzed as a separate sample; this type of field QA/QC sample is also referred to as a field split sample (PSEP 1997). A minimum of one field duplicate sample will be analyzed for every 20 samples.

In addition, a single rinsate blank sample will be collected for each program (in-water and upland) by rinsing laboratory distilled water over the sample homogenization equipment. The rinsate blank sample will be analyzed for the full suite of chemical analyses for each program.

Although data validation guidelines have not been established for field QC samples, the data resulting from the analyses of these samples will be useful in identifying possible problems resulting from sample collection or sample processing in the field. All field QC samples will be documented on the field log and verified by the project QA/QC coordinator or a designee.

4.5.2 Chemical Analysis QC Criteria

Before analyzing the samples, the laboratory must provide written protocols for the analytical methods to be used, calculate MDLs for each analyte in each matrix type, and establish an initial calibration curve for all analytes. The laboratory must demonstrate their continued proficiency through participation in inter-laboratory comparison studies and through repeated analyses of SRMs, calibration checks, method blanks, and spiked samples.

4.5.2.1 Sample Delivery Group

Project- and/or method-specific QC measures such as MS/MSD or laboratory replicate samples will be analyzed per sample delivery group (SDG), preparatory batch, or analytical batch, as specified in Table 5. An SDG is defined as no more than 20 samples or a group of samples received at the laboratory within a 2-week period. Although an SDG may span 2 weeks, all holding times specific to each analytical method will be met for each sample in the SDG.

4.5.2.2 Laboratory QC Criteria

The laboratory analysts will review the results of QC analyses of each analytical batch (described below) immediately after the samples have been analyzed. The QC sample results will be evaluated to determine whether control limits have been exceeded. If control limits are exceeded, then appropriate corrective action must be initiated before a subsequent group of samples can be processed (e.g., recalibration followed by reprocessing of the affected samples). The project QA/QC coordinator must be contacted immediately by the laboratory PM if satisfactory corrective action to achieve the DQIs outlined in this QAPP is not possible. All laboratory corrective action reports relevant to the analysis of project samples must be included in the data deliverable packages.

All primary chemical standards and standard solutions used in this project will be traceable to the National Institute of Standards and Technology, Environmental Resource Associates, National Research Council of Canada, or other documented, reliable commercial sources. The accuracy of the standards should be verified through comparison with an independent standard. Laboratory QC standards are verified a multitude of ways. Second-source calibration verification (i.e., same chemicals manufactured by two different vendors) are analyzed to verify initial calibrations. New working standard mixes (e.g., calibrations, spikes) should be verified against the results of the original solution before being put into use and be within 10% of the true value. Newly purchased standards should be verified against current data. Any impurities found in the standard must be documented.

The following subsections summarize the procedures that will be used to assess data quality throughout sample analysis.

Laboratory Replicate Samples

Laboratory replicate samples provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Laboratory replicates are subsamples of the original sample that are prepared and analyzed as a separate sample, assuming sufficient sample matrix is available. A minimum of one laboratory replicate sample will be analyzed for each SDG or for every 20 samples, whichever is more frequent, for inorganic and conventional parameters.

Matrix Spikes and Matrix Spike Duplicates

The analysis of MS samples provides information on the extraction efficiency of the method on the sample matrix. Through the performance of MSD analyses, information on the precision of the method is also provided for organic analyses. For organic analyses, a minimum of one MS/MSD pair will be analyzed for each SDG, when sufficient sample volume is available. For inorganic analyses (i.e., metals), a minimum of one MS sample will be analyzed for each SDG, when sufficient sample volume is available. MS/MSD samples are not performed for dioxin/furan analyses.

Method Blanks

Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. A minimum of one method blank will be analyzed for each extraction/digestion batch or for every 20 samples, whichever is more frequent.

Standard Reference Material

SRMs are samples of similar matrix and of known analyte concentration that are processed through the entire analytical procedure and used as an indicator of method accuracy. A minimum of one SRM will be analyzed for each SDG or for every 20 samples, whichever is more frequent.

Surrogate Spikes

All project samples analyzed for organic compounds will be spiked with appropriate surrogate compounds as defined in the analytical methods. Surrogate recoveries will be reported by the laboratories; however, no sample results will be corrected for recovery using these values, with the exception of the isotope dilution corrections that are required elements of the dioxin analysis (EPA 1613).

Laboratory Control Samples

LCSs are prepared from a clean matrix similar to the project samples and are spiked with known amounts of the target compounds. The recoveries of the compounds are used as a measure of the

accuracy of the test methods. LCS recoveries will be reported by the laboratories; however, no sample results will be corrected for recovery using these values.

Internal Standard Spikes

Internal standard spikes may be used for calibrating and quantifying organic compounds and metals by means of inductively coupled plasma-mass spectrometry (ICP-MS). If internal standards are used, all calibration, QC, and project samples will be spiked with the same concentration of the selected internal standard(s). Internal standard recoveries and retention times must be within method and/or laboratory criteria.

4.6 Instrument/Equipment Testing, Inspection, and Maintenance

Prior to each field event, measures will be taken to test, inspect, and maintain all field equipment. All equipment used, including the GPS unit and digital camera will be tested for use before leaving for the field event.

The FC will be responsible for overseeing the testing, inspection, and maintenance of all field equipment. The laboratory PM will be responsible for ensuring that laboratory equipment testing, inspection, and maintenance requirements are met. The methods used in calibrating the analytical instrumentation are described in the following section.

4.7 Instrument/Equipment Calibration and Frequency

Multipoint initial calibrations will be performed on each instrument prior to sample analysis, after each major interruption to the analytical instrument, and when more than one continuing calibration verification sample does not meet the specified criteria. The number of points used in the initial calibration is defined in each analytical method. Continuing calibration verifications will be performed daily for organic analyses, once every 10 samples for the inorganic analyses and with every sample batch for conventional parameters to ensure proper instrument performance.

The field PID will be calibrated daily per the instructions in the instrument instruction manual.

4.8 Inspection/Acceptance of Supplies and Consumables

The field team leaders for each sampling event will have a checklist of supplies required for each day in the field (see Section 3.2.5). The FC will gather and check these supplies daily for satisfactory conditions before each field event. Batteries used in the GPS unit and digital camera will be checked daily and recharged as necessary. Supplies and consumables for field sampling will be inspected upon delivery and accepted if the condition of the supplies is satisfactory. For example, jars will be inspected to ensure that they are the correct size and quantity and have not been damaged in shipment.

4.9 Data Management

All field data will be recorded on field forms (see Appendix B), which will be checked for missing information by the FC at the end of each field day and amended as necessary. After sampling has been completed, all data from field forms will be scanned and entered into a Microsoft Excel® spreadsheet for import into the project database. A secondary QC check will be done to ensure that 100% of the data were properly transferred from the field forms to the spreadsheet. The scanned field forms and spreadsheet will be kept in the project folder on a secured network, which is backed up daily. All photographs will be transferred to the project folder at the end of the sampling effort.

Analytical laboratories are expected to submit data in an electronic format as described in Section 3.3.3. The laboratory PM will contact the project QA/QC coordinator prior to data delivery to discuss specific format requirements. All laboratory data will be stored in a secured EQuIS database.

5 Assessment and Oversight

5.1 Compliance Assessments and Response Actions

EPA or their designees may observe field activities during each sampling event, as needed. If situations arise in which there is an inability to follow QAPP methods precisely, the PM will determine the appropriate actions or consult EPA if the issue is significant.

5.1.1 Compliance Assessments

Laboratory and field performance assessments consist of on-site EPA reviews of sampling procedures, QA systems, adherence to the QAPP, and equipment for sampling, calibration, and measurement. EPA personnel may conduct a laboratory audit prior to sample analysis. Any pertinent laboratory audit reports will be made available to the project QA/QC coordinator upon request. Analytical laboratories are required to have written procedures to address internal QA/QC; these procedures will be submitted to the project QA/QC coordinator for review to ensure compliance with the QAPP. All laboratories and QA/QC coordinators are required to ensure that all personnel engaged in sampling and analysis tasks have appropriate training.

5.1.2 Response Actions for Field Sampling

The FC, or a designee, will be responsible for correcting equipment malfunctions throughout field sampling and for resolving situations in the field that may result in nonconformance or noncompliance with the QAPP. All corrective measures will be immediately documented in the field logbook, and protocol modification forms will be completed.

5.1.3 Corrective Action for Laboratory Analyses

Analytical laboratories are required to comply with their current written standard operating procedures (SOPs), laboratory QA plan, and analytical methods. Laboratory personnel will identify and correct any anomalies before continuing with sample analysis and will be responsible for reporting problems that may compromise the quality of the data. The laboratory PMs will be responsible for ensuring that appropriate corrective actions are initiated, as required, for conformance with this QAPP.

The project QA/QC coordinator will be notified immediately if any QC parameter exceeds the project DQIs outlined in this QAPP (Table 5) and cannot be resolved through standard corrective action procedures. A description of the anomaly, the steps taken to identify and correct the anomaly, and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, and re-extraction) will be submitted with the data package and described in the case narrative or corrective action form.

5.2 Reports to Management

The PM will update the Port and EPA regarding the status of field sampling activities following the sampling event. The project QA/QC coordinator will also update the Port and EPA after the sampling is completed and samples have been submitted for analyses, when information is received from the laboratory, and when analyses are complete. The status of the samples and analyses will be indicated with emphasis on any deviations from the QAPP. A data report will be prepared after validated data are available, as described in Section 3.3.4.

6 Data Validation and Usability

6.1 Data Validation

Once data are received from the laboratory, a number of QC procedures will be followed to provide an accurate evaluation of data quality. A Stage 2B data quality review will be performed for all testing parameters except dioxin/furans which will undergo a Stage 4 validation. Data quality review will be completed by Laboratory Data Consultants in accordance with EPA National Functional Guidelines (EPA 2014, 2017a, 2017b) by considering the following:

- Data completeness
- Holding times
- Method blanks
- Surrogate recoveries
- Detection limits
- Laboratory control samples
- Replicates
- MS/MSD samples
- Initial and continuing calibrations
- Internal Standard area recoveries
- SRM data
- Compound quantitations (Stage 4 only)

Data will be validated in accordance with the DQIs (Table 6), analytical method criteria, and the laboratory's internal performance standards based on its SOPs. The results of the data quality review, including assigning qualifiers in accordance with the EPA National Functional Guidelines (EPA 2014, 2017a, 2017b) and a tabular summary of qualifiers, will be generated by the database manager and submitted to the QA/QC Manager for final review and confirmation of data validity.

Laboratory data, which will be electronically provided and loaded into Anchor QEA's project database, will undergo a 5% check against the laboratory hard copy data. Data will be validated or reviewed manually, and qualifiers, if assigned, will be entered manually. The accuracy of all manually entered data will be verified by a second party. Data tables and reports will be exported from EQuIS to Excel tables.

Field datasheets will be checked for completeness and accuracy prior to delivery to the database manager. Data generated in the field will be documented on hard copy and provided to the database manager, who is responsible for data entry into the database. Manually entered data will be checked by a second party. Field documentation will be filed in the main project file after data entry and checking are complete.

6.2 Reconciliation with Data Quality Objectives

The data quality assessment will be conducted by the project QA/QC coordinator. The results of the third-party independent review and validation will be reviewed, and cases where the project's DQOs were not met will be identified. The usability of the data depends on a variety of factors and will be determined in terms of the magnitude of the DQO exceedance. The QA/QC coordinator will consult the data user to provide a context-specific evaluation of the impact of qualified data on its use.

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Tables

Table 1
Upland Sampling Design

Location ID	Easting	Northing	Existing Elevation (ft MLLW)	Design Subgrade Elevation (ft MLLW)	Estimated Excavation depth (ft bgs)	Sample Interval[a, b] (ft bgs)	Sample Analysis	Location Rationale	Relevant DQO
SB-01	1267861	212685	16.1	6.2	9.9	0 - 10	Excavation Material[c]	Located within footprint of former cold storage facility, data gap area with no historical data.	Disposal characterization, characterize post-excavation surface
						10 - 12	Full Suite[d]		
						12 - 14	Archive		
						14 - 16	Archive		
						16 - 18	Archive		
						18 - 20	Archive		
SB-02	1267649	212490	12.0	9.3	2.7	0 - 1.5	Excavation Material[c]	Spatial coverage of shoreline within treated wood piling area. Geotechnical evaluation to include static stability for areas along the shoreline.	Disposal characterization, characterize post-excavation surface, geotechnical
						1.5 - 3	SPT[e]		
						3 - 5	Full Suite[d]		
						5 - 7	Archive		
						7 - 8.5	SPT[e]		
						8.5 - 10.5	Archive		
						10.5 - 12.5	Archive		
						12.5 - 14	SPT[e]		
						14 - 16	Archive		
						16 - 18	Archive		
						18 - 19.5	SPT[e]		
						19.5 - 23.5	Observation Only[b]		
						23.5 - 25	SPT[e]		
SB-03	1267739	212415	15.6	8.0	7.6	0 - 7.5	Excavation Material[c]	Located within the former footprint of the sawmill and adjacent to an underground storage tank removal and soil excavation area for hydrocarbon contamination (Sweet-Edwards 1990). Geotechnical evaluation to include static and seismic stability for areas receiving considerable excavation.	Disposal characterization, characterize post-excavation surface, geotechnical
						1.5 - 3	SPT[e]		
						6 - 7.5	SPT[e]		
						7.5 - 9.5	Full Suite[d]		
						9.5 - 11.5	Archive		
						11.5 - 13	SPT[e]		
						13 - 15	Archive		
						15 - 17	Archive		
						17 - 18.5	SPT[e]		
						18.5 - 20.5	Archive		
						20.5 - 23.5	Observation Only[b]		
						23.5 - 25	SPT[e]		
						25 - 75[g]	SPT[e,f]		

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Upland Sampling Design

Location ID	Easting	Northing	Existing Elevation (ft MLLW)	Design Subgrade Elevation (ft MLLW)	Estimated Excavation depth (ft bgs)	Sample Interval[a, b] (ft bgs)	Sample Analysis	Location Rationale	Relevant DQO
SB-04	1267508	212256	16.6	5.8	10.8	0 - 11.0	Excavation Material[c]	Spatial coverage of far southwest area of Site adjacent to a former maintenance building, mill boiler, and sawmill. Geotechnical evaluation to include static stability in areas of considerable excavation.	Disposal characterization, characterize post-excavation surface, geotechnical
						3.5 - 5	SPT[e]		
						9.5 - 11.0	SPT[e]		
						11.0 - 13.0	Full Suite[d]		
						13.0 - 15.0	Archive		
						15.0 - 16.5	SPT[e]		
						16.5 - 18.5	Archive		
						18.5 - 20.5	Archive		
						20.5 - 23.5	Observation Only[b]		
						23.5 - 25.0	SPT[e]		
SB-05	1267693	212719	10.6	6.9	3.7	0 - 4	Excavation Material[c]	Intertidal bank location in northern edge of property adjacent to the footprint of the former Cold Storage Facility and within treated wood piling area. Previous surface sediment sampling in the intertidal bank area reported SMS exceedances of pentachlorophenol and PAHs (Anchor QEA 2012).	Disposal characterization, characterize post-excavation surface
						4 - 6	Full Suite[d]		
						6 - 8	Archive		
						8 - 10	Archive		
						10 - 12	Archive		
						12 - 14	Archive		
						14 - 16	Archive		
						16 - 18	Archive		
						18 - 20	Archive		
SB-06	1267667	212608	10.2	10.0	0.2	0 - 2	Full Suite[d]	Intertidal bank location adjacent to the footprint of the former Cold Storage Facility and within treated wood piling area. Previous surface sediment sampling in the intertidal bank area reported SMS exceedances of pentachlorophenol and PAHs (Anchor QEA 2012).	Disposal characterization, characterize post-excavation surface
						2 - 4	Archive		
						4 - 6	Archive		
						6 - 8	Archive		
						8 - 10	Archive		
						10 - 12	Archive		
						12 - 14	Archive		
						14 - 16	Archive		
						16 - 18	Archive		
						18 - 20	Archive		

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Upland Sampling Design

Location ID	Easting	Northing	Existing Elevation (ft MLLW)	Design Subgrade Elevation (ft MLLW)	Estimated Excavation depth (ft bgs)	Sample Interval[a, b] (ft bgs)	Sample Analysis	Location Rationale	Relevant DQO
SB-07	1267849	212476	15.2	7.1	8.1	0 - 8	Excavation Material[e]	Located of former compressor building, automobile preparation, and automobile undercoating facilities. Data gap area with no historical data.	Disposal characterization, characterize post-excavation surface
						8 - 10	Full Suite[d]		
						10 - 12	Archive		
						12 - 14	Archive		
						14 - 16	Archive		
						16 - 18	Archive		
						18 - 20	Archive		
SB-08	1267534	212430	16.4	4.1	12.4	0 - 12	Excavation Material[c]	Shoreline sampling location in southwest portion of property receiving considerable excavation. Adjacent to the former Maintainance Building footprint.	Disposal characterization, characterize post-excavation surface
						12 - 14	Full Suite[d]		
						14 - 16	Archive		
						16 - 18	Archive		
						18 - 20	Archive		
SB-09	1267665	212373	14.7	7.1	7.6	0 - 8	Excavation Material[c]	Located within the western extent of former sawmill and adjacent to former machine and workshop structures. Data gap area with no historical data.	Disposal characterization, characterize post-excavation surface
						8 - 10	Full Suite[d]		
						10 - 12	Archive		
						12 - 14	Archive		
						14 - 16	Archive		
						16 - 18	Archive		
						18 - 20	Archive		
SB-10	1267919	212294	16.5	13.5[g]	3.0[g]	0 - 2	Full Suite[d, i]	Located adjacent to the former sawmill along the southern extent of the project area. Near historical location B-10, which had elevated levels of PAHs and petroleum odors approximately 10 feet bgs (Blymyer 1989).	Disposal characterization, characterize post-excavation surface
						2 - 4	Archive		
						4 - 6	Archive		
						6 - 8	Archive		
						8 - 10	Archive		
						10 - 12	Archive		
						12 - 14	Archive		
						14 - 16	Archive		
						16 - 18	Archive		
						18 - 20	Archive		

Table 1
Upland Sampling Design

Location ID	Easting	Northing	Existing Elevation (ft MLLW)	Design Subgrade Elevation (ft MLLW)	Estimated Excavation depth (ft bgs)	Sample Interval[a, b] (ft bgs)	Sample Analysis	Location Rationale	Relevant DQO
SB-11	1267638	212231	17.1	8.7	8.5	0 - 9	Excavation Material[c]	Spatial coverage of southern boundary of Site near former transformer area. Data gap area with no historical data.	Disposal characterization, characterize post-excavation surface
						9 - 11	Full Suite[d]		
						11 - 13	Archive		
						13 - 15	Archive		
						15 - 17	Archive		
						17 - 19	Archive		
						19 - 20	Archive		
SB-12	1267984	212687	16.4	15.4[h]	1.0[h]	0 - 2	Full Suite[d, i]	Located within footprint of former cold storage facility and along a proposed bike trail and stormwater pond area. Data gap area with no historical data.	Disposal characterization, characterize post-excavation surface
						2 - 4	Archive		
						4 - 6	Archive		
						6 - 8	Archive		
						8 - 10	Archive		
						10 - 20	Observation Only[b]		
SB-13	1267984	212440	15.0	14.0[h]	1.0[h]	0 - 2	Full Suite[d, i]	Located adjacent the former Sawmill along a proposed bike trail and stormwater pond area. Data gap area with no historical data.	Disposal characterization, characterize post-excavation surface
						2 - 4	Archive		
						4 - 6	Archive		
						6 - 8	Archive		
						8 - 10	Archive		
						10 - 20	Observation Only[b]		
SB-14	1268160	212610	16.4	15.4[h]	1.0[h]	0 - 2	Full Suite[d, i]	Located within footprint of former cold storage facility and along eastern edge of the project boundary. Data gap area with no historical data.	Disposal characterization, characterize post-excavation surface
						2 - 4	Archive		
						4 - 6	Archive		
						6 - 8	Archive		
						8 - 10	Archive		
						10 - 20	Observation Only[b]		
SB-15	1268106	212395	15.0	14.0[h]	1.0[h]	0 - 2	Full Suite[d, i]	Located within the footprint of the former Sawmill and automobile preparation buildings. Data gap area with no historical data.	Disposal characterization, characterize post-excavation surface
						2 - 4	Archive		
						4 - 6	Archive		
						6 - 8	Archive		
						8 - 10	Archive		
						10 - 20	Observation Only[b]		

Table 1
Upland Sampling Design

Location ID	Easting	Northing	Existing Elevation (ft MLLW)	Design Subgrade Elevation (ft MLLW)	Estimated Excavation depth (ft bgs)	Sample Interval[a, b] (ft bgs)	Sample Analysis	Location Rationale	Relevant DQO

Notes:
Coordinates are in NAD83 WA State Plane North, U.S. Feet.
a. Sample intervals may be adjusted due to anthropogenic debris encountered during sampling.
b. Discrete samples will be collected within lithological layers with visual indicators of contamination (sheen), odors, or elevated PID readings relative to ambient conditions.
c. Sample collected for characterization of excavated soils including TPH-Dx, TCLP metals, SVOCs, PAHs, PCBs, TS
d. Full upland chemical suite includes: grain size, TS/TOC, metals, SVOCs, PAHs, Total PCB Aroclors, D/Fs

e. Proposed SPT sample interval is approximate and may be adjusted to prioritize chemistry sampling. A subset of SPT samples collected with a split-spoon sampler will be analyzed for atterberg limits, grain size, moisture content, and bulk density as determined by field staff. Excess sample volume will be included in the associated excavattion material sample interval or archived (deeper intervals).
f. SPT samples will be collected every 5 ft to an approximate depth of 75 ft bgs, methods will conform to ASTM D 1586
g. Design elevations are not available for this location; an excavation depth of 3 feet is assumed.
h. Design elevations are not available for this location; an excavation depth of 1 foot is assumed.
i. Sample interval will also be run for TCLP metals for potential disposal characterization
bgs: below ground surface
D/F: dioxin/furans
DQO: data quality objective
ID: identification
ft: feet
MLLW: mean lower low water
NAD83: North American Datum of 1983
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
PID: photoionization detector
SMS: sediment management standards
SPT: standard penetration test
SVOC: semi-volatile organic compounds
TCLP: toxicity characteristic leaching procedure
TOC: total organic carbon
TPH: total petroleum hydrocarbons
TS: total solids
TVS: total volatile solids

Table 2
Sediment Sampling Design

Location ID	Easting	Northing	Existing Elevation (ft MLLW)	Design Subgrade Elevation (ft MLLW)	Estimated Dredge Depth (ft)	Sample Interval[a] (ft)	Sample Analysis[a]	Location Rationale		
								Dredging location?	Within Piling Field?	Relevant DQO
SC-01	1267799	212813	6.0	2.6	3.4	0 - 3.4	Dredge Material[b]	yes	yes	Disposal characterization, characterize post-dredge surface
						3.4 - 4.4	Full Suite[c]			
						Additional 1 ft intervals until bottom of core	Archive			
SC-02	1267703	212810	6.0	-1.5	7.6	0 - 7.6	Dredge Material[b]	yes	yes	Disposal characterization, characterize post-dredge surface
						7.6 - 8.6	Full Suite[c]			
						Additional 1 ft intervals until bottom of core	Archive			
SC-03	1267677	212749	6.2	-0.1	6.3	0 - 6.3	Dredge Material[b]	yes	yes	Disposal characterization, characterize post-dredge surface
						6.3 - 7.3	Full Suite[c]			
						Additional 1 ft intervals until bottom of core	Archive			
SC-04	1267622	212597	6.2	0.7	5.6	0 - 5.6	Dredge Material[b]	yes	yes	Disposal characterization, characterize post-dredge surface
						5.6 - 6.6	Full Suite[c]			
						Additional 1 ft intervals until bottom of core	Archive			
SC-05	1267396	212371	2.5	-4.8	7.3	0 - 7.3	Dredge Material[b]	yes	no	Disposal characterization, characterize post-dredge surface
						7.3 - 8.3	Full Suite[c]			
						Additional 1 ft intervals until bottom of core	Archive			
SC-06	1267525	212523	-9.3	--[d]	--[d]	0 - 1	Full Suite[c]	no	outer edge	Spatial characterization
						Additional 1 ft intervals until bottom of core	Archive			
SC-07	1267578	212705	-23.0	--[d]	--[d]	0 - 1	Full Suite[c]	no	outer edge	Spatial characterization
						Additional 1 ft intervals until bottom of core	Archive			
SC-08	1267625	212874	-26.4	--[d]	--[d]	0 - 1	Full Suite[c]	no	outer edge	Spatial characterization
						Additional 1 ft intervals until bottom of core	Archive			
SC-09	1267734	212901	-34.2	--[d]	--[d]	0 - 1	Full Suite[c]	no	outer edge	Spatial characterization
						Additional 1 ft intervals until bottom of core	Archive			

Notes:
Coordinates are in NAD83 WA State Plane North, U.S. Feet.
a. Additional samples for grain size, atterberg limits, moisture content, and specific gravity will be collected within discrete lithological layers from select locations to inform the geotechnical program.
b. Sample collected for characterization of dredged sediments includes TCLP metals, SVOCs, PAHs, PCBs, and TS.
c. Full Sediment chemical suite includes: grain size, TS/TOC, metals, SVOCs, PAHs, Total PCB Aroclors, and dioxins/furans.
d. Location is outside of proposed dredge area.
DQO: data quality objective
ft: feet
MLLW: mean lower low water
NAD83: North American Datum of 1983
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
SVOC: semivolatile organic carbon
TCLP: toxicity characteristic leaching procedure
TOC: total organic carbon
TS: total solids

Table 3
Guidelines for Sample Handling and Storage

Parameter	Sample Size	Container Size and Type[a]	Holding Time	Preservative
Soil and Sediment				
Total metals	100 g	4-oz Glass	6 months; 28 days for mercury	4° C ± 2° C
			2 years; 28 days for mercury	-18° C ± 2° C
SVOCs/PAHs, PCBs	750 g	2 x 16-oz Glass	14 days until extraction	4° C ± 2° C
			1 year until extraction	-18° C ± 2° C
			40 days after extraction	4° C ± 2° C
TPH-Dx (Upland only)			14 days until extraction	4° C ± 2° C
			40 days after extraction	4° C ± 2° C
Dioxins/furans	100 g	8-oz Amber Glass	1 year until extraction	4° C ± 2° C or -18° C ± 2° C
Grain size	500 g	16-oz Glass, HDPE, or plastic bag	6 months	4° C ± 2° C
Total solids/total organic carbon	375 g	8-oz Glass or HDPE	14 days	4° C ± 2° C
			6 months	-18° C ± 2° C
Chemistry archive	500 g	16-oz Glass	1 year until extraction	Freeze/-18° C
Atterberg Limits	500 g	16-oz Glass, HDPE, or plastic bag	6 months	Cool/4° C
Moisture Content				
Bulk Density (Upland only)	--	3-inch diameter Shelby Tube or 16-oz Glass		

Table 3
Guidelines for Sample Handling and Storage

Parameter	Sample Size	Container Size and Type[a]	Holding Time	Preservative
Rinsate Blanks				
Total Metals	--	500mL HDPE with HNO_3	6 months; 28 days for mercury	Cool/4° C; HNO_3 to pH<2
SVOCs/PAHs	--	2 x 500mL Amber Glass	7 days until extraction 40 days after extraction	Cool/4° C
PCBs	--	2x 500mL Amber Glass	1 year until extraction 40 days after extraction	Cool/4° C
TPH-Dx (Upland only)	--	2x 1L Amber Glass	1 year until extraction 40 days after extraction	Cool/4° C
Dioxins/furans	--	2x 1L Amber Glass	1 year until extraction 40 days after extraction	Cool/4° C

Notes:

a. All sample containers will have lids with Teflon inserts.

°C: degrees Celsius

g: grams

HDPE: high density polyethylene

L: liter

mL: milliliter

oz: ounces

PAH: polycyclic aromatic hydrocarbon

PCB: polychlorinated biphenyl

SVOC: semivolatile organic compound

TPH: total petroleum hydrocarbons

Table 4
Parameters for Analysis, Screening Levels, Analytical Methods, and Target Quantitation Limits

Parameter	Analytical Method	Quantitation Limit	SMS Marine Sediment		Marine SMS AET	
			SCO	CSL	SCO	CSL
Conventional Parameters, %						
Total solids	SM2540G/PSEP	0.1	---	---	---	---
Total organic carbon	Plumb, 1981/EPA 9060 Mod	0.1	---	---	---	---
Metals - mg/kg dry weight						
Arsenic	6010C/6020A	5.0	57	93	57	93
Cadmium	6010C/6020A	0.2	5.1	6.7	5.1	6.7
Chromium	6010C/6020A	0.5	260	270	260	270
Copper	6010C/6020A	0.2	390	390	390	390
Lead	6010C/6020A	2.0	450	530	450	530
Mercury	7471B	0.025	0.41	0.59	0.41	0.59
Silver	6010C/6020A	0.3	6.1	6.1	6.1	6.1
Zinc	6010C/6020A	1.0	410	960	410	960
TCLP Metals - µg/L						
Arsenic	1311/6010C	0.250	---	---	---	---
Barium	1311/6010C	0.015	---	---	---	---
Cadmium	1311/6010C	0.010	---	---	---	---
Chromium	1311/6010C	0.025	---	---	---	---
Lead	1311/6010C	0.100	---	---	---	---
Mercury	1311/6010C	0.0001	---	---	---	---
Selenium	1311/6010C	0.250	---	---	---	---
Silver	1311/6010C	0.015	---	---	---	---
Polycyclic Aromatic Hydrocarbons - µg/kg dry weight			**mg/kg OC**		**µg/kg dry weight**	
Naphthalene	8270D	20.0	99	170	2,100	2,100
Acenaphthylene	8270D	20.0	66	66	1,300	1,300
Acenaphthene	8270D	20.0	16	57	500	500
Fluorene	8270D	20.0	23	79	540	540
Phenanthrene	8270D	20.0	100	480	1,500	1,500
Anthracene	8270D	20.0	220	1,200	960	960
2-Methylnaphthalene	8270D	20.0	38	64	670	670
Total LPAH[a]	calculated	---	370	780	5,200	5,200
Fluoranthene	8270D	20.0	160	1,200	1,700	2,500
Pyrene	8270D	20.0	1,000	1,400	2,600	3,300
Benzo(a)anthracene	8270D	20.0	110	270	1,300	1,600
Chrysene	8270D	20.0	110	460	1,400	2,800
Total benzo(b,j,k)fluoranthenes	8270D	40.0	230	450	3,200	3,600
Benzo(a)pyrene	8270D	20.0	99	210	1,600	1,600
Indeno(1,2,3-cd)pyrene	8270D	20.0	34	88	600	690
Dibenz(a,h)anthracene	8270D	5.0	12	33	230	230
Benzo(g,h,i)perylene	8270D	20.0	31	78	670	720
Total HPAHs[b]	calculated	---	960	5,300	12,000	17,000
Chlorinated Hydrocarbons - µg/kg dry weight			**mg/kg OC**		**µg/kg dry weight**	
1,4-Dichlorobenzene	8270D SIM Dual Scan	5.0	3.1	9	110	110
1,2-Dichlorobenzene	8270D SIM Dual Scan	5.0	2.3	2.3	35	50
1,2,4-Trichlorobenzene	8270D SIM Dual Scan	5.0	0.81	1.8	31	51
Hexachlorobenzene (HCB)	8270D SIM Dual Scan	5.0	0.38	2.3	22	70
Hexachlorobutadiene	8270D SIM Dual Scan	5.0	3.9	6.2	11	120

Table 4
Parameters for Analysis, Screening Levels, Analytical Methods, and Target Quantitation Limits

Parameter	Analytical Method	Quantitation Limit	SMS Marine Sediment		Marine SMS AET	
			SCO	CSL	SCO	CSL
Phthalates - µg/kg dry weight			**mg/kg OC**		**µg/kg dry weight**	
Dimethyl phthalate	8270D SIM Dual Scan	5.0	53	53	71	160
Diethyl phthalate	8270D SIM Dual Scan	5.0	61	110	200	>1,200
Di-n-butyl phthalate	8270D	20.0	220	1,700	1,400	1,400
Butyl benzyl phthalate	8270D	20.0	4.9	64	63	900
Bis(2-ethylhexyl) phthalate	8270D	50.0	47	78	1300	1900
Di-n-octyl phthalate	8270D	20.0	58	4,500	6,200	6,200
Phenols - µg/kg dry weight						
Phenol	8270D SIM Dual Scan	5.0	420	1,200	420	1,200
2-Methylphenol	8270D SIM Dual Scan	5.0	63	63	63	63
4-Methylphenol	8270D SIM Dual Scan	5.0	670	670	670	670
2,4-Dimethylphenol	8270D SIM Dual Scan	25.0	29	29	29	29
Pentachlorophenol	8270D SIM Dual Scan	20.0	360	690	360	690
Miscellaneous Extractables - µg/kg dry weight			**mg/kg OC (unless noted)**		**µg/kg dry weight**	
Benzyl Alcohol	8270D SIM Dual Scan	20.0	57 dry wt	73 dry wt	57	73
Benzoic Acid	8270D SIM Dual Scan	100.0	650 dry wt	650 dry wt	650	650
Dibenzofuran	8270D	20.0	15	58	540	540
N-Nitrosodiphenylamine	8270D SIM Dual Scan	5.0	11	11	28	40
Polychlorinated Biphenyls - µg/kg dry weight (unless noted)			**mg/kg OC**		**µg/kg dry weight**	
Total Aroclor PCBs	8082	4.0	12	65	130	1,000
Dioxin/Furans - ng/kg dry weight						
Dioxins						
2,3,7,8-TCDD	1613B	1.0	---	---	---	---
1,2,3,7,8-PeCDD	1613B	1.0	---	---	---	---
1,2,3,4,7,8-HxCDD	1613B	2.5	---	---	---	---
1,2,3,6,7,8-HxCDD	1613B	2.5	---	---	---	---
1,2,3,7,8,9-HxCDD	1613B	2.5	---	---	---	---
1,2,3,4,6,7,8-HpCDD	1613B	2.5	---	---	---	---
OCDD	1613B	5.0	---	---	---	---
Furans						
2,3,7,8-TCDF	1613B	1.0	---	---	---	---
1,2,3,7,8-PeCDF	1613B	2.5	---	---	---	---
2,3,4,7,8,-PeCDF	1613B	1.0	---	---	---	---
1,2,3,4,7,8-HxCDF	1613B	2.5	---	---	---	---
1,2,3,6,7,8-HxCDF	1613B	2.5	---	---	---	---
1,2,3,7,8,9-HxCDF	1613B	2.5	---	---	---	---
2,3,4,6,7,8-HxCDF	1613B	2.5	---	---	---	---
1,2,3,4,6,7,8-HpCDF	1613B	2.5	---	---	---	---
1,2,3,4,7,8,9-HpCDF	1613B	2.5	---	---	---	---
OCDF	1613B	5.0	---	---	---	---
Total TEQ	1613B	4.0	---	---	---	---
Bulk Petroleum Hydrocarbons - mg/kg dry weight (Upland Samples Only)						
TPH-Diesel	NWTPH-Dx	50.0	---	---	---	---
TPH-Residual	NWTPH-Dx	100.0	---	---	---	---

Table 4
Parameters for Analysis, Screening Levels, Analytical Methods, and Target Quantitation Limits

Parameter	Analytical Method	Quantitation Limit	SMS Marine Sediment		Marine SMS AET	
			SCO	CSL	SCO	CSL
Geotechnical						
Atterberg limits (%)	ASTM D 4318	0.1	--	--	--	--
Specific gravity	ASTM D 854	0.01	--	--	--	--
Bulk density (g/cc)	ASTM D 2937	0.1	--	--	--	--
Grain size (%)	ASTM D421/422	0.1	--	--	--	--
Moisture content (%)	ASTM D 2216	0.1	--	--	--	--

Notes:

a. Total LPAH consists of the sum of naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene.

b. Total HPAH consists of the sum of fluoranthene, pyrene, benz(a)anthracene, chrysene, benzo(b,j,k)fluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

µg/kg: micrograms per kilogram

µg/L: micrograms per liter

AET: Apparent Effects Threshold

CSL: cleanup screening level

EPA: U.S. Environmental Protection Agency

HPAH: high-density polycyclic aromatic hydrocarbons

LPAH: low-density polycyclic aromatic hydrocarbons

mg/kg: milligrams per kilogram

ng/kg: nanograms per kilogram

OC: organic carbon normalized

OCDD: octachlorodibenzodioxin

OCDF: octachlorodibenzofuran

PCB: polychlorinated biphenyl

PSEP: Puget Sound Estuary Program

SMS: Sediment Management Standards

SCO: sediment cleanup objective

TEQ: toxic equivalency quotient

TPH: total petroleum hydrocarbons

Table 5
Data Quality Indicators

Parameter	Precision (Laboratory Replicates)	Accuracy			Completeness
		Instrument Calibration (% Difference)	Spiked Samples (% Recovery)	Surrogates[a]	
Grain size	± 20% RSD	NA	NA	NA	95%
Total solids	± 20% RSD	NA	NA	NA	95%
Total organic carbon	± 20% RSD	NA	65% – 135% R	NA	95%
Total metals	± 20% RPD	±10	75% – 125% R	NA	95%
SVOCs/PAHs	± 35% RPD	±20	50% – 150% R	Lab limits	95%
TPH	± 35% RPD	±20	50% – 150% R	Lab limits	95%
Dioxin/Furans	± 35% RPD	±25	50% – 150% R	Lab limits	95%
Polychlorinated biphenyls	± 35% RPD	±20	50% – 150% R	Lab limits	95%
Geotechnical Parameters	NA	NA	NA	NA	95%

Notes:

a. Laboratory performance limits are established for each method/analyte.

NA: not applicable

PAH: polycyclic aromatic hydrocarbon

R: recovery

RPD: relative percent difference

RSD: relative standard deviation

SVOC: semivolative organic carbon

TPH: Total petroleum hydrocarbons

TVS: total volatile solids

Table 6
Quality Control Sample Analysis Summary

Analysis Type	Field Quality Control Elements		Laboratory Quality Control Elements							
	Field Duplicate	Field/Equipment Blank	Initial Calibration	Ongoing Calibration	Replicates	Laboratory Control Sample or Certified Reference Material[f]	Matrix Spikes	Matrix Spike Duplicates	Method Blanks	Surrogate Spikes
Grain size	1 per 20 samples	NA	Each batch[a]	NA	Triplicates required per batch	NA	NA	NA	NA	NA
Total solids	1 per 20 samples	NA	Each batch[a]	NA	Triplicates required per batch	NA	NA	NA	NA	NA
Total organic carbon	1 per 20 samples	NA	Daily or each batch	1 per 10 samples	Triplicates required per batch	1 per 20 samples or 1 per batch, whichever is more frequent	NA	NA	1 per 20 samples or 1 per batch, whichever is more frequent	NA
Metals	1 per 20 samples	1 per sampling event	Daily	1 per 10 samples	Duplicates required per batch	1 per 20 samples or 1 per batch, whichever is more frequent	1 per 20 samples or 1 per batch, whichever is more frequent	NA	1 per 20 samples or 1 per batch, whichever is more frequent	NA
SVOCs/PAHs	1 per 20 samples	1 per sampling event	As needed[b]	Every 12 hours[c]	Matrix spike duplicate may be used	1 per 20 samples or 1 per batch, whichever is more frequent	1 per 20 samples or 1 per batch, whichever is more frequent	1 per 20 samples or 1 per batch, whichever is more frequent	1 per 20 samples or 1 per batch, whichever is more frequent	Every sample
TPH	1 per 20 samples	1 per sampling event	As needed[b]	1 per 10 samples[c]	Matrix spike duplicate may be used	1 per 20 samples or 1 per batch, whichever is more frequent	1 per 20 samples or 1 per batch, whichever is more frequent	NA	1 per 20 samples or 1 per batch, whichever is more frequent	Every sample
Dioxin/Furans	1 per 20 samples	1 per sampling event	As needed[b]	Every 12 hours[c]	Duplicates required per batch	1 per 20 samples or 1 per batch, whichever is more frequent	NA	NA	1 per 20 samples or 1 per batch, whichever is more frequent	Every sample[e]
PCBs[d]	1 per 20 samples	1 per sampling event	As needed[b]	1 per 10 samples[c]	Matrix spike duplicate may be used	1 per 20 samples or 1 per batch, whichever is more frequent	1 per 20 samples or 1 per batch, whichever is more frequent	1 per 20 samples or 1 per batch, whichever is more frequent	1 per 20 samples or 1 per batch, whichever is more frequent	Every sample

Notes:

a. Calibration and certification of drying ovens and weighing scales are conducted bi-annually.

b. Initial calibrations are considered valid until the ongoing continuing calibration no longer meets method specifications. At that point, a new initial calibration is performed.

c. Ongoing calibrations at the beginning and end of each batch.

d. PCBs will have all detects confirmed via second column confirmation. The second column must be of a dissimilar stationary phase from the primary column and meet all method requirements for acceptance.

e. Isotope dilution with labeled compounds required in every sample.

f. An ongoing precision and recovery (OPR) sample functions as a laboratory control sample to assess the accuracy of the analysis of dioxins/furans. Duplicate OPR samples may be used to assess the precision of the analysis of dioxins/furans.

NA: not applicable

PAH: polycyclic aromatic hydrocarbon

PCB: polychlorinated biphenyls

SVOC: semivolatile organic compounds

TPH: total petroleum hydrocarbons

Figures

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ANCHOR QEA

Figure 1
Vicinity Map
Quality Assurance Project Plan
Port of Seattle Terminal 25 South Design Characterization

SOURCE: Drawing prepared from survey by The Watershed Company. Bathymetry from the Port of Seattle, dated January-March 2018.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND

Existing Contour (2-foot Interval)

Existing OHWM

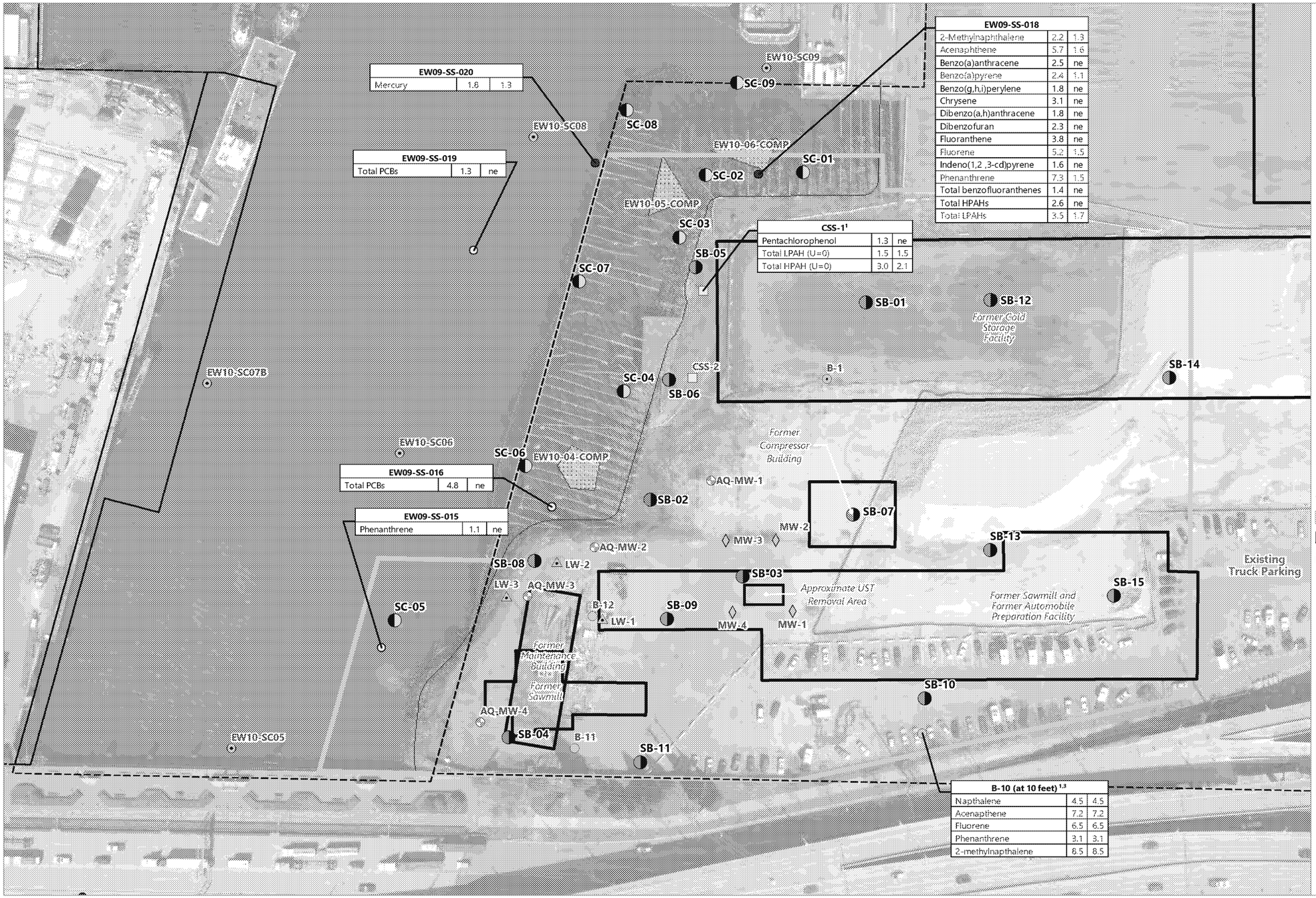
0 80
Feet

Publish Date: 2018/05/30 1:54 PM | User: tgriga
Filepath: K:\Projects\0003-Port of Seattle\POS SD-01 - T-25 Wetlands\0003-WK-006 (TWC Design and XS).dwg Figure 2

ANCHOR QEA

Figure 2
Existing Site Topography/Bathymetry

Quality Assurance Project Plan
Port of Seattle Terminal 25 South Design Characterization



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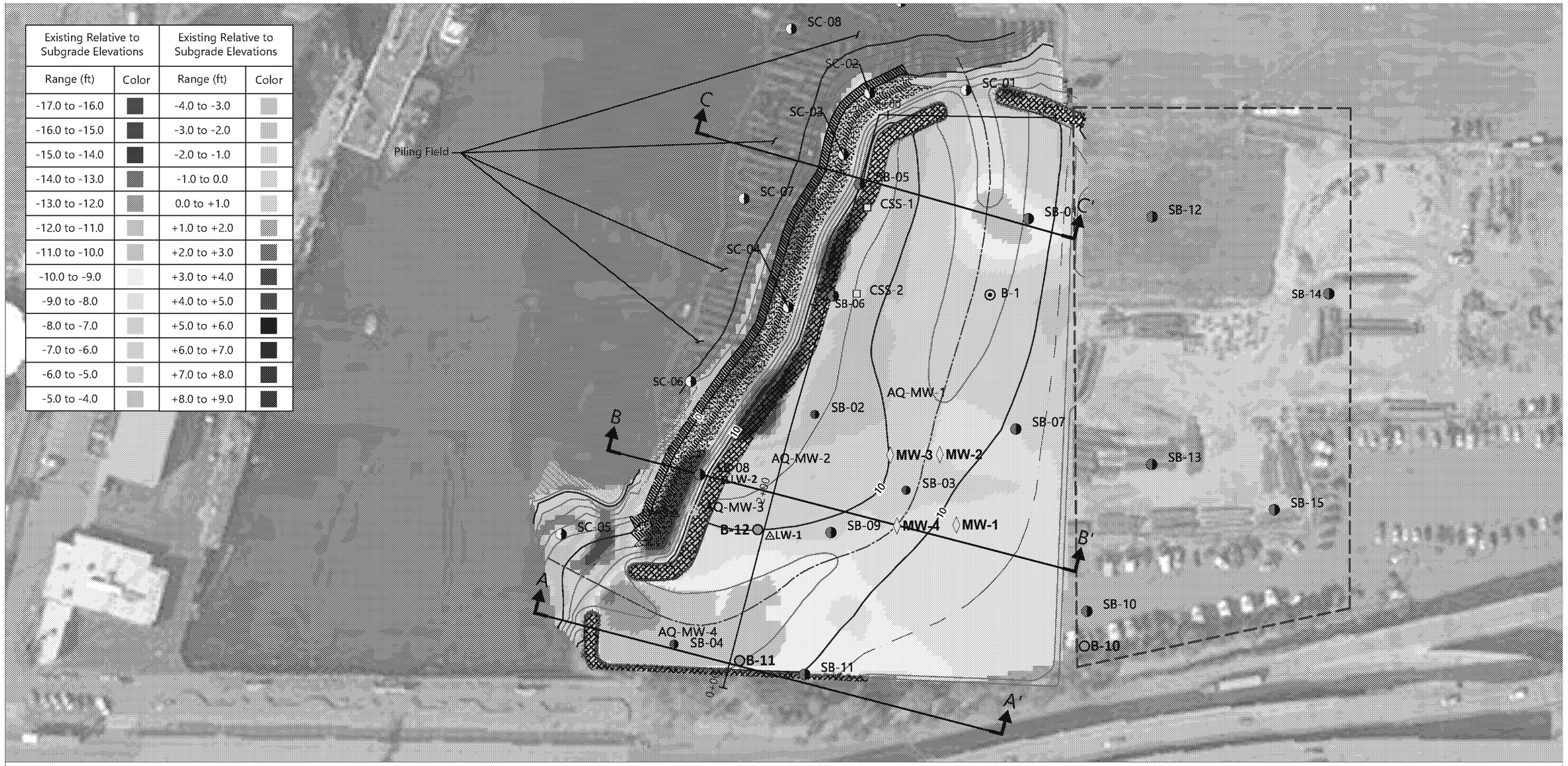
ANCHOR QEA

Figure 3
Proposed Sampling Locations
Quality Assurance Project Plan
Port of Seattle Terminal 25 South Design Characterization

Existing Relative to Subgrade Elevations		Existing Relative to Subgrade Elevations	
Range (ft)	Color	Range (ft)	Color
-17.0 to -16.0		-4.0 to -3.0	
-16.0 to -15.0		-3.0 to -2.0	
-15.0 to -14.0		-2.0 to -1.0	
-14.0 to -13.0		-1.0 to 0.0	
-13.0 to -12.0		0.0 to +1.0	
-12.0 to -11.0		+1.0 to +2.0	
-11.0 to -10.0		+2.0 to +3.0	
-10.0 to -9.0		+3.0 to +4.0	
-9.0 to -8.0		+4.0 to +5.0	
-8.0 to -7.0		+5.0 to +6.0	
-7.0 to -6.0		+6.0 to +7.0	
-6.0 to -5.0		+7.0 to +8.0	
-5.0 to -4.0		+8.0 to +9.0	



SOURCE: Drawing prepared from survey by The Watershed Company. Bathymetry from the Port of Seattle, dated January-March 2018.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND

- Existing OHWM
- Proposed Contour (2-foot Interval)
- Proposed Slope Centerline
- Proposed Mean High High Water
- Proposed Cribwall
- Proposed Berm with Large Woody Debris
- Proposed Intertidal Shelf
- Proposed Bio-cement Mattress
- Proposed Eel Grass Bench
- Proposed Kelp Bench
- Potential Excavation Area
- Cross Section Location and Designation

UPLAND BORING LOCATIONS

- Chemistry
- Chemistry and Geotechnical

SEDIMENT CORING LOCATIONS

- Sample Location

HISTORICAL BORINGS

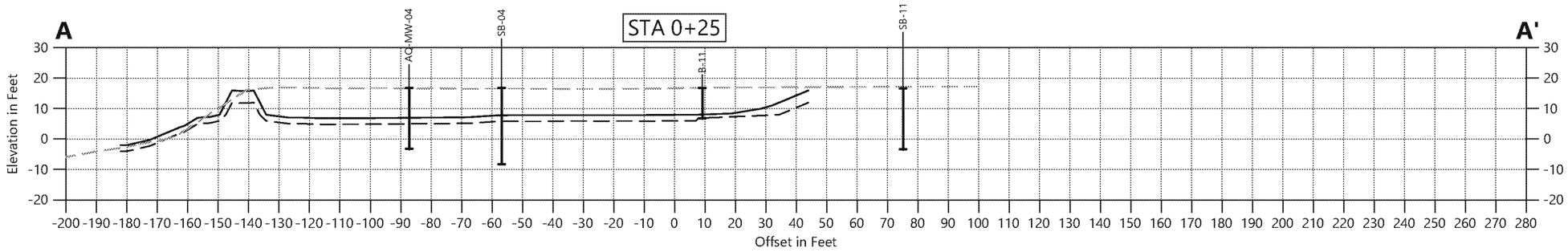
- Geotech Boring (Shannon and Wilson, 2008)
- Soil Boring (Blymyer, 1989)
- Soil Boring and Monitoring Well (Landau, 1990)
- Soil Boring and Monitoring Well (Sweet-Edwards/Emcon, 1990)
- Soil Boring and Monitoring Well (Anchor QEA, 2012)
- Surface Sediment Composite (Anchor QEA, 2012)

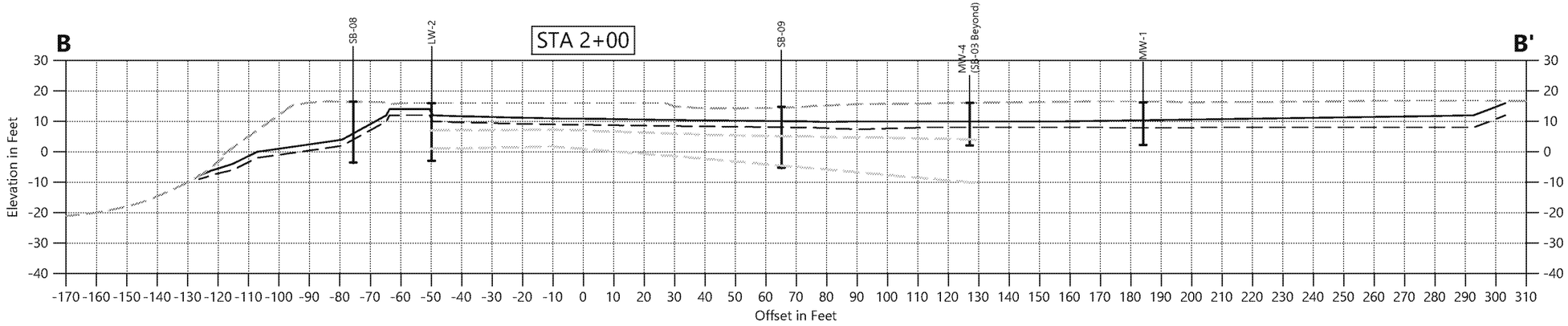
0 100 Feet

Publish Date: 2018/11/15 2:08 PM | User: chewett
Filepath: K:\Projects\0303-Port of Seattle\POS 50-01 - T-25 Wetland\0093-WK-006 (TWC Design and XS).dwg F4_Land

ANCHOR QEA

Figure 4
Project Elevation Changes
Quality Assurance Project Plan
Port of Seattle Terminal 25 South Design Characterization





SOURCE: Drawing prepared from survey by The Watershed Company. Bathymetry from the Port of Seattle, dated January-March 2018.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- Existing Grade
- Proposed Grade
- Proposed Subgrade
- Approximate Top and Bottom of Wood Debris

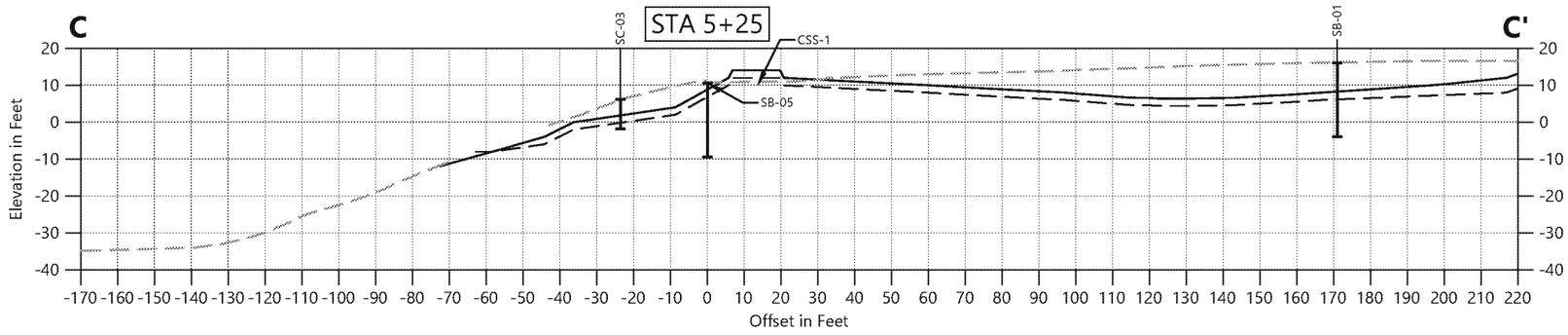
0 40
Feet

Publish Date: 2018/05/30 1:34 PM | User: tgriga
Filepath: K:\Projects\0003-Port of Seattle\P05 SD-01 - T-25 Wetland\0003-WR-006 (TWC Design and XS).dwg Figure 5a

ANCHOR QEA

Figure 5a
Cross Sections

Quality Assurance Project Plan
Port of Seattle Terminal 25 South Design Characterization



SOURCE: Drawing prepared from survey by The Watershed Company.
Bathymetry from the Port of Seattle, dated January-March 2018.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

Existing Grade

Proposed Grade

Proposed Subgrade

0 40
Feet

Publish Date: 2018/05/30 1:34 PM | User: igriga
Filepath: K:\Projects\0003-Port of Seattle\P05 SD-01 - T-25 Wetland\0003-WR-006 (TWC Design and XS).dwg Figure 5b

ANCHOR QEA

Figure 5b
Cross Sections

Quality Assurance Project Plan
Port of Seattle Terminal 25 South Design Characterization

Appendix A
Health and Safety Plan

January 2019
Port of Seattle T-25 South Design Characterization

ANCHOR QEA

Health and Safety Plan

January 2019
Port of Seattle T-25 South Design Characterization

Health and Safety Plan

Prepared by
Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle WA 98101

Certification Page

Dan Berlin

Project Manager

Anchor QEA, LLC

Date: January 4, 2019

Evan Malczyk

Field Lead

Anchor QEA, LLC

Date: January 4, 2019

The information in this Health and Safety Plan has been designed for the Port of Seattle T-25 South Design Characterization project presently contemplated by Anchor QEA, LLC. Therefore, this document may not be appropriate if the work is not performed by or using the methods presently contemplated by Anchor QEA. In addition, as the work is performed, conditions different from those anticipated may be encountered and this document may have to be modified. Therefore, Anchor QEA only intends this plan to address currently anticipated activities and conditions and makes no representations or warranties as to the adequacy of the Health and Safety Plan for all conditions encountered.

Health and Safety Plan Acknowledgement Form

Project Number: 160003-03.01

Project Name: Port of Seattle T-25 South Design Characterization

My signature below certifies that I have read and understand the policies and procedures specified in this Health and Safety Plan (HASP). For non-Anchor QEA employees, this HASP may include company-specific appendices to this plan developed by entities other than Anchor QEA. Non-affiliated personnel may be required to sign the Liability Waiver following this Acknowledgement Form.

Date	Name (print)	Signature	Company

Date	Name (print)	Signature	Company

Site Emergency Procedures

Site Map

Figure A
General Site Location Overview

Emergency Contact Information

Table A
Site Emergency Form and Emergency Phone Numbers*

Category	Information
Possible Chemicals of Concern	BTEX/TPH/PAH/PCB/DF/Metals
Minimum Level of Protection	Modified Level D
Site(s) Location Address	Terminal 25, Seattle, Washington

Category	Information	
Emergency Phone Numbers		
Ambulance	911	
Fire	911	
Police	911	
Poison Control	(800) 222-1222	
Client Contact (Port of Seattle)	Brick Spangler	Phone: (206) 295-9538
Project Manager (PM)	Dan Berlin	Office: (206) 903-3322 Cell: (206) 409-7268
Field Lead (FL)	Evan Malczyk	Office: (206) 219-5891 Cell: (206) 799-3669
Corporate Health and Safety Manager (CHSM)	David Templeton	Office: (206) 287-9130 Cell: (206) 910-4279
EPA Emergency Response Team,[1] Region 10	(800) 424-4372	
Washington Emergency Management Division	(800) 258-5900	

Notes:
* In the event of any emergency, contact the PM and FL.

1. For local resources, please visit: http://www2.epa.gov/emergency-response/emergency-response-my-community. The National Response Center hotline is 1-800-424-8802.

Table B
Hospital Information

Category	Information
Hospital Name	Virginia Mason Hospital
Address	1100 9th Ave
City, State	Seattle, Washington
Phone	(206) 223-6600
Emergency Phone	911

Hospital Route Map and Driving Directions

1. Head South on E Marginal Way
2. Turn right onto S Spokane St
3. Turn left onto Duwamish Ave
4. Use the right lane to merge onto E Marginal Way S
5. Turn right onto S Spokane St
6. Take the ramp onto I-5 N
7. Continue on I-5 north to Exit 164A to 7th Ave
8. Turn right onto Seneca St. Follow 3 blocks to the Hospital

Figure B
Hospital Route Map

Care Management—WorkCare Incident Intervention

Anchor QEA has an additional Incident Intervention resource from WorkCare to help answer questions, alleviate uncertainty and stress in a potential injury situation, and maintain the health and safety of our employees. Incident Intervention is an injury and illness management tool that provides

employees with 24 hours a day/7 days a week (24/7) immediate telephone access to a member of WorkCare's clinical staff of nurses and physicians who intervene at the time of a workplace injury or illness. Contact information is provided below:

- **Access WorkCare 24/7 from anywhere using the toll-free number: 1-888-449-7787**

At the time of a workplace injury or illness, the employee, manager, or another employee at the scene notifies WorkCare using the toll-free number listed above. The caller provides information on the type of incident, possible cause, and the scope of the situation. With the details of the incident recorded, an experienced nurse or physician provides the following:

- Responsive evaluation of the incident
- Direction on the appropriate course of action
- Consultation with the employee's treating physician to design a quality care treatment plan that meets the needs of the employee and Anchor QEA

All employees are encouraged to use this service should a workplace injury or illness occur.

Key Safety Personnel

The following people share responsibility for health and safety at the site. See Section 4 of this Health and Safety Plan (HASP) for a description of the role and responsibility of each.

Client Contact: Brick Spangler	Phone: (206) 295-9538
Project Manager (PM): Dan Berlin	Office: (206) 903-3322 Cell: (206) 409-7268
Field Lead (FL): Evan Malczyk	Office: (206) 219-5891 Cell: (206) 799-3669
Corporate Health and Safety Manager (CHSM): David Templeton	Office: (206) 287-9130 Cell: (206) 910-4279

Personal Incident Response Procedures

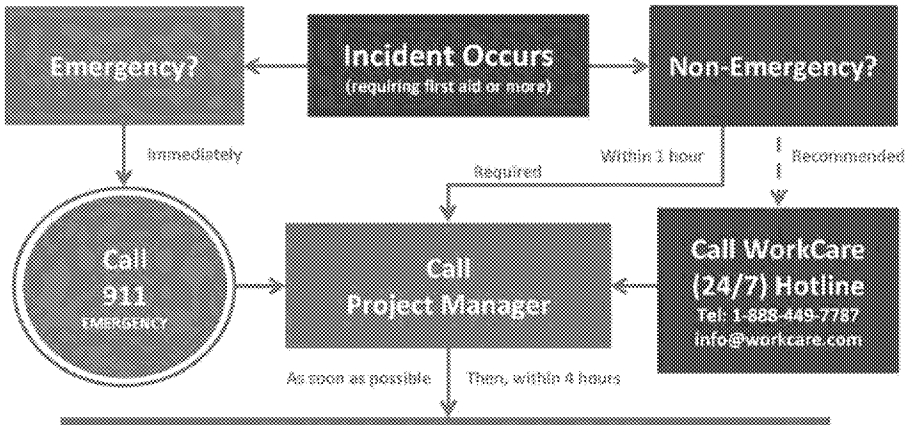
In the event of an emergency, immediate action must be taken by the first person to recognize the event. Use the following steps as a guideline and refer to Figure C:

1. Survey the situation to verify that it is safe for you and the victim. Do not endanger your own life. Do not enter an area to rescue someone who has been overcome unless properly equipped and trained. Verify that all protocols are followed. If applicable, review Safety Data Sheets (SDS) to evaluate response actions for chemical exposures.
2. Call the appropriate emergency number (911, if available) or direct someone else to do this immediately (see Table A). Explain the physical injury, chemical exposure, fire, or release and location of the incident.

3. Have someone retrieve the nearest first aid kit (containing appropriate items for the particular work scope) and Automated External Defibrillator (AED), if available. Note: Only use an AED if you have been properly trained and are currently certified to do so.
4. Decontaminate the victim without delaying life-saving procedures (see Section 8).
5. Administer first aid and cardiopulmonary resuscitation (CPR), if properly trained, until emergency responders arrive.[1]
6. In the event that evacuation is required, the FL must perform a head count to verify that all Anchor QEA personnel are accounted for.
7. Notify the Field Lead (FL) and Project Manager (PM); the PM will notify the client contact. The PM will also contact the Corporate Health and Safety Manager (CHSM). The CHSM will facilitate the incident investigation. All client requirements pertinent to personal incident reporting will also be adhered to.
8. Complete the appropriate incident investigation reports.

[1] Personnel qualified and currently certified in basic first aid or CPR are protected under Good Samaritan policies as long as they only perform the basic tasks that they were taught. Do not perform first aid or CPR tasks if you have not been trained in first aid or CPR.

Figure C
Incident Flowchart



Project Manager Calls H&S Representative Below Within 1 Hour (step through the list until a person is reached)	
Chris Torell Health and Safety Manager	Cell (call or text): (315) 254-4954 ctorell@anchorqea.com
David Templeton Health and Safety Director	Cell (call or text): (206) 910-4279 dtempleton@anchorqea.com
Gloria Palermo Health and Safety Coordinator	Cell: (315) 622-3723 gpalermo@anchorqea.com
Elizabeth Barnick Human Resources Director	Cell: (909) 455-8091 ebarnick@anchorqea.com

Non-Personal Incident Response Procedures

All incidents including, but not limited to, fire, explosion, property damage, or environmental release will be responded to in accordance with the site-specific HASP. In general, this includes securing the site appropriate to the incident, turning control over to the emergency responders, or securing the site and summoning appropriate remedial personnel or equipment. Anchor QEA will immediately notify the client of any major incident, fire, equipment or property damage, or environmental incident with a preliminary report. A full report will be provided within 72 hours.

Spills and Releases of Hazardous Materials

When required, notify the National Response Center and local state agencies. The following information should be provided to the National Response Center:

- Name and telephone number

- Name and address of incident location
- Time and type of incident
- Name and quantity of materials involved, if known
- Extent of injuries
- Possible hazards to human health or the environment outside of the facility

The emergency telephone number for the National Response Center is 1-800-424-8802. If hazardous waste is released or produced through control of the incident, verify that:

- Waste is collected and contained
- Containers of waste are removed or isolated from the immediate site of the emergency
- Treatment or storage of the recovered waste, contaminated soil or surface water, or any other material that results from the incident or its control is provided
- No waste that is incompatible with released material is treated or stored in the facility until cleanup procedures are completed

Verify that all emergency equipment used is decontaminated, recharged, and fit for its intended use before operations are resumed.

Near-Miss Reporting

All near-miss incidents (i.e., those that could have reasonably led to an injury, environmental release, or other incident) must be reported to the FL and PM immediately so action can be taken to verify that such conditions that led to the near-miss incident are readily corrected to prevent future occurrences.

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
AED	Automated External Defibrillator
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
APR	Air-Purifying Respirator
ASTM	ASTM International
CDC	Centers for Disease Control
CFR	Code of Federal Regulations
CHSM	Corporate Health and Safety Manager
COC	chemical of concern
CPR	cardiopulmonary resuscitation
CRZ	Contamination Reduction Zone
dbA	A-weighted decibel
dB	decibel
DOT	U.S. Department of Transportation
DPT	direct push technology
EPA	U.S. Environmental Protection Agency
eV	electron volts
EZ	Exclusion Zone/Hot Zone
FID	flame ionization detector
FL	Field Lead
GFCI	ground-fault circuit interrupter
H:V	horizontal to vertical
HASP	Health and Safety Plan
HAZMAT	Hazardous Materials
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	high-efficiency particulate air
HMIS	Hazardous Material Information System
IDLH	immediately dangerous to life or health
JSA	Job Safety Analysis
kPa	kilopascal
kV	kilovolt
LEL	lower-explosive limit
LO/TO	lockout/tagout
mg/m^3	milligram per cubic meter
MHR	maximum heart rate
MUTCD	Manual of Uniform Traffic Control Devices

NEC	National Electrical Code
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NPL	National Priority List
NRR	Noise Reduction Rating
O_2	oxygen
OSHA	Occupational Safety and Health Act or Administration
OV	organic vapor
OVM	organic vapor monitor
PAH	polycyclic aromatic hydrocarbon
PE	Professional Engineer
PEL	Permissible Exposure Limit
PFD	personal flotation device
PID	photoionization detector
PM	Project Manager
PPE	personal protective equipment
ppm	parts per million
PRCS	Permit-Required Confined Spaces
QLFT	qualitative fit test
REL	Recommended Exposure Limit
RCRA	Resource Conservation and Recovery Act
RPP	Respiratory Protection Program
SDS	Safety Data Sheets
SZ	Support Zone/Clean Zone
TLV	Threshold Limit Value
TSD	treatment, storage, and disposal
tsf	ton per square foot
TWA	time-weighted average
TWIC	Transportation Worker Identification Credential
USCG	U.S. Coast Guard
UV	ultraviolet
VOC	volatile organic compound
WBGT	wet bulb globe temperature
XRF	x-ray fluorescence

1 Introduction

This Health and Safety Plan (HASP) was prepared on behalf of Port of Seattle and presents health and safety requirements and procedures that will be followed by Anchor QEA, LLC, personnel and at a minimum by Anchor QEA subcontractors during work activities at the Terminal 25 South (T-25S) Design Characterization (the site). This HASP was developed in accordance with Title 29 of the Code of Federal Regulations (CFR), Part 1910.120(b), and will be used in conjunction with Anchor QEA's Corporate Health and Safety Program. See Section 1.1 for HASP modification procedures.

The provisions of this HASP are mandatory for all Anchor QEA personnel assigned to the project. A copy of this HASP must be maintained on site and available for employee review at all times. Anchor QEA subcontractors are also expected to follow the provisions of this HASP unless they have their own HASP that covers their specific activities related to this project. Any subcontractor HASPs must include the requirements set forth in this HASP, at a minimum. All visitors to the work site must also abide by the requirements of this HASP and will attend a pre-work briefing where the contents of this HASP will be presented and discussed.

Personnel assigned to work at the project site will be required to read this plan and must sign the Health and Safety Plan Acknowledgement Form to confirm that they understand and agree to abide by the provisions of this HASP.

Subcontractors are ultimately responsible for the health and safety of their employees. Subcontractors may mandate health and safety protection measures for their employees beyond the minimum requirements specified in this HASP.

The objectives of this HASP are to identify potential physical, chemical, and biological hazards associated with field activities; establish safe working conditions and protective measures to control those hazards; define emergency procedures; and describe the responsibilities, training requirements, and medical monitoring requirements for site personnel.

This HASP prescribes the procedures that must be followed during specific site activities. Significant operational changes that could affect the health and safety of personnel, the community, or the environment will not be made without the prior approval of the Project Manager (PM) and the Corporate Health and Safety Manager (CHSM).

Issuance of this approved HASP documents that the workplace has been evaluated for hazards. A hazard assessment was performed, and the adequacy of the personal protective equipment (PPE) selected was evaluated as required by 29 CFR 1910.132(d)—Personal Protective Equipment, General Requirements (General Industry); 29 CFR 1910.134—Respiratory Protection; 29 CFR 1926.28—Personal Protective Equipment (Construction Industry); and 29 CFR 1926.55—Gases, Vapors, Fumes,

Dusts and Mist, and is duly noted by the signature(s) and date appearing on the certification page of this document.

1.1 Health and Safety Plan Modifications

This HASP will be modified by amendment, if necessary, to address changing field conditions or additional work tasks not already described in this document. Modifications will be proposed by the Field Lead (FL) using the Modification to Health and Safety Plan form included in Appendix A. Modifications will be reviewed by the CHSM or authorized representative and approved by the PM.

2 Site Description and Background Information

2.1 Project Background

T-25S was initially constructed by dredging and filling activities in the early 1900s, when the Duwamish River was reconfigured to the current channel location. In addition to sediment fill placement at T-25S, other upland fill materials (associated with the regrading of Beacon Hill and Denny Hill) were placed. From 1915 to approximately 1930, the location of the proposed restoration project on T-25S was used for cold storage, logging facilities, and as a sawmill. By 1930, the mill operations were expanded. The mill site was removed to allow for lumber storage and automobile staging in the early 1960s. Additional automobile undercoating facilities were constructed in the 1970s. T-25S was acquired by the Port in the late 1970s. During the 1980s, T-25S was used for cold storage, seafood processing, and shipping operations. Most structures and buildings were demolished at T-25S in the 1990s, with the cold storage building demolished in the early 2000s.

2.2 Site Description

T-25S is bounded to the east by East Marginal Way, to the south by Spokane Street, to the west by the East Waterway, and to the north by the active terminal facility (Figure 1). The Port currently leases T-25S to various tenants who use the area for equipment and material laydown, light industrial activity, and truck parking. The southeastern portion of T-25S includes the City of Seattle's (City's) right-of-way and is used as a paved, active construction laydown area. The south-central portion of T-25S is paved with asphalt and is used as a parking area for trucks. The northern portion of T-25S is currently leased by a tenant to the Port and used for concrete crushing and recycling operations. The western portion of T-25S contains paved and unpaved portions and abuts the eastern shoreline of the East Waterway. The southwestern portion of T-25S is used as a log and woody debris storage area. The western and northwestern areas of T-25S are currently unused.

3 Scope of Work

3.1 Project Scope of Work

The Sampling and Analysis Plan (Anchor QEA 2018) describes the collection and handling of sediment samples for chemical analyses. Elements include sampling design; sampling methods; sample handling and custody requirements; analytical methods; QA/QC, instrument/equipment testing and frequency, inspection, and maintenance; instrument calibration; supply inspection/acceptance; and data management.

This plan addresses health and safety issues associated with the following field tasks:

- Collection of upland cores
- Collection of sediment cores
- Processing cores
- Handling investigation-derived waste
- Decontamination of sampling equipment

4 Authority and Responsibilities of Key Personnel

This section describes the authority and responsibilities of key Anchor QEA project personnel. The names and contact information for the following key safety personnel are listed in the Site Emergency Procedures section at the beginning of this HASP. Should key site personnel change during the course of the project, a new list will be established and posted immediately at the site. The emergency phone number for the site is **911** and should be used for all medical, fire, and police emergencies.

4.1 Project Manager

The PM provides overall direction for the project. The PM is responsible for ensuring that the project meets the client's objectives in a safe and timely manner. The PM is responsible for providing qualified staff for the project and adequate resources and budget for the health and safety staff to carry out their responsibilities during the field work. The PM will be in regular contact with the FL and CHSM to verify that appropriate health and safety procedures are implemented into each project task.

The PM has authority to direct response operations; the PM assumes total control over project activities but may assign responsibility for aspects of the project to others. In addition, the PM performs the following tasks:

- Oversees the preparation and organization of background review of the project, the Scope of Work, and the field team
- Verifies that the team obtains permission for site access and coordinates activities with appropriate officials
- Briefs the FL and field personnel on specific assignments
- Together with the FL, sees that health and safety requirements are met
- Consults with the CHSM regarding unsafe conditions, incidents, or changes in site conditions or the Scope of Work

4.2 Field Lead

The FL reports to the PM, has authority to direct response operations, and assumes control over on-site activities. The FL will direct field activities, will coordinate the technical and health and safety components of the field program, and is responsible in general for enforcing this site-specific HASP and Corporate Health and Safety Program requirements. The FL will be the primary point of contact for all field personnel and visitors and has direct responsibility for implementation and administration of this HASP. The FL and any other member of the field team have **STOP WORK AUTHORITY**—the authority to stop or suspend work in the event of an emergency, if conditions arise that pose an unacceptable health and safety risk to the field team or environment, or if

conditions arise that warrant modifications to this HASP. It is critical that both the FL and PM communicate regularly to proactively identify and address any safety-related concerns that may arise. The following include, but are not necessarily limited to, the functions of the FL related to this HASP:

- Conduct and document daily safety meetings, or designate an alternate FL in his or her absence.
- Execute the Scope of Work and schedule.
- Conduct periodic field health and safety inspections to verify compliance with this HASP.
- Oversee implementation of safety procedures.
- Implement site personnel protection levels.
- Enforce site control measures to help verify that only authorized personnel are allowed on site.
- Notify, when necessary, local public emergency officials (all personnel on site may conduct this task as needed).
- Follow-up on incident reports to the PM.
- Periodically inspect protective clothing and equipment for adequacy and safety compliance.
- Verify that protective clothing and equipment are properly stored and maintained.
- Perform or oversee air monitoring (if required) in accordance with this HASP.
- Maintain and oversee operation of monitoring equipment and interpretation of data from the monitoring equipment.
- Monitor site personnel for signs of stress, including heat stress, overexertion, cold exposure, and fatigue.
- Require participants to use the "buddy" system in performing tasks.
- Provide (via implementation of this HASP) emergency procedures, evacuation routes, and telephone numbers for the local hospital, poison control center, fire department, and police department.
- Communicate incidents promptly to the PM.
- Maintain communication with the CHSM regarding on-site activities.
- If applicable, verify that decontamination and disposal procedures are followed.
- Maintain the availability of required safety equipment.
- Advise appropriate health services and medical personnel of potential exposures.
- Notify emergency response personnel in the event of an emergency and coordinate emergency medical care.

The FL will record health-and-safety-related details of the project in the field logbook. At a minimum, each day's entries must include the following information:

- Project name or location
- Names of all on-site personnel

- Level of PPE worn and any other specifics regarding PPE
- Weather conditions
- Type of field work being performed

The FL will have completed the required Occupational Safety and Health Administration (OSHA) 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and annual updates, the 8-hour Supervisor training, medical monitoring clearance, and current first aid and cardiopulmonary resuscitation (CPR) training. Other certifications or training may be stipulated based on client or site requirements.

4.3 Corporate Health and Safety Manager

The CHSM (or designee) will be responsible for managing on-site health and safety activities and will provide support to the PM and FL on health and safety-related issues. The following are specific duties of the CHSM:

- Provide technical input into the design and implementation of this HASP.
- Advise on the potential for occupational exposure to project hazards, along with appropriate methods and/or controls to eliminate site hazards.
- Verify that a hazard assessment has been performed and that the adequacy of the PPE selected was evaluated as required by 29 CFR 1910.132(d), 29 CFR 1910.134, 29 CFR 1926.25, and 29 CFR 1926.55, and is duly noted by the signatures and date appearing on the Certification Page of this document.
- Consult with the FL on matters relating to suspending site activities in the event of an emergency.
- Verify that all on-site Anchor QEA personnel and subcontractors have read and signed the HASP Acknowledgement Form.
- Verify that corrective actions resulting from deficiencies identified by audit and observations are implemented and effective.

The CHSM or designee will have completed the required OSHA 40-hour HAZWOPER training and annual updates as well as the 8-hour Supervisor training (or a minimum of 5 years of supervisory experience).

4.4 Project Field Team

All project field team members will attend a project-specific meeting conducted by the FL concerning safety issues and project work task review before beginning work on site. All field team members, including subcontractors, must be familiar with and comply with this HASP. The field team has the responsibility to immediately report any potentially unsafe or hazardous conditions to the FL, and all members of the field team have **STOP WORK AUTHORITY**—the authority to stop or

suspend work if conditions arise that pose an unacceptable health and safety risk to the field team or environment, or if conditions arise that warrant modifications to this HASP. It is critical that all field team members proactively communicate with the FL to identify potential unsafe conditions. The field team reports to the FL for on-site activities and is responsible for the following:

- Reviewing and maintaining a working knowledge of this HASP
- Safe completion of on-site tasks required to fulfill the Scope of Work
- Compliance with the HASP
- Attendance and participation in daily safety meetings
- Notification to the FL of existing or potential safety conditions at the site
- Reporting all incidents to the FL
- Demonstrating safety and health-conscious conduct

Per OSHA 1910.120(e)(3)(i),[2] newly assigned HAZWOPER 40-hour trained field team members must have at least 3 days of field work supervised by an experienced FL (preferably an individual with HAZWOPER Supervisor training). It is the responsibility of the PM to identify such "short service" personnel and verify that their supervised field experience occurs (or has occurred) and is documented in the project field notes and on the Daily Safety Briefing form (Appendix A).

[2] "General site workers (such as equipment operators, general laborers and supervisory personnel) engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous substances and health hazards shall receive a minimum of 40 hours of instruction off the site, and a minimum of three days actual field experience under the direct supervision of a trained experienced supervisor."

5 Project-Specific Requirements

This section provides activity-specific levels of protection and air monitoring requirements to be used on this site based on the Scope of Work and the chemicals of concern (COCs).

5.1 Activity-Specific Level of Protection Requirements

Refer to Section 10 for general requirements for PPE. Level D is the minimum acceptable level for most sites. An upgrade to Modified Level D occurs when there is a possibility that contaminated media can come in contact with the skin or work uniform. An upgrade to Level C occurs when there is a potential for exposure to airborne COCs (i.e., if the results of air monitoring reveal that action levels have been exceeded). Hearing protection must be worn when there are high noise levels. Site personnel must maintain proficiency in the use and care of PPE that is to be worn.

Table 5-1 describes the specific means of protection needed for each identified work activity.

Table 5-1
Project Job Tasks and Required PPE

Job Tasks		PPE Requirements
• Loading and unloading sample coolers, boat equipment, general non-sampling activities on boat	☒	Standard work uniform/coveralls
	☒	Work boots with safety toe conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05
	☒	High-visibility traffic safety vest
	☐	Chemical-resistant clothing check appropriate garments: ☐ One-piece coverall ☐ Hooded one- or two-piece chemical splash suit ☐ Disposable chemical coveralls ☐ Chemical-resistant hood and apron ☐ Bib-style overalls and jacket with hood **Fabric Type**: Tyvek NOTE: Thick rain pants and coveralls may be substituted for coated Tyvek if sediments are not obviously contaminated with polycyclic aromatic hydrocarbons (PAHs) or related petroleum products. Rain slickers cannot be effectively decontaminated of tar/petroleum contamination.
	☐	Disposable inner gloves (latex or equivalent "surgical")
	☐	Disposable chemical-resistant outer gloves **Material Type**: Nitrile
	☐	Chemical-resistant boots with safety toe conforming to ASTM F2412-05/ASTM F2413-05 or disposable boot covers for safety toe/work boots **Material Type**: Rubber or leather
	☐	Puncture-resistant shanks in safety shoes conforming to ASTM F2412-05/ASTM F2413-05
	☐	Metatarsal guards conforming to ASTM F2412-05/ASTM F2413-05
	☐	Sleeves to be duct-taped over gloves and pants to be duct-taped over boots
	☐	Splash-proof safety goggles
	☐	Safety glasses
	☒	Hard hat
	☐	Hard hat with face shield
	☒	Hearing protectors (**REQUIRED** if site noise levels are greater than 85 decibels [dB] based on an 8-hour time-weighted average [TWA]). **Type**: Ear plugs
	☐	Two-way radio communication (intrinsically safe, if explosive atmosphere is a potential)
	☐	Long cotton underwear

Job Tasks		PPE Requirements
	☒	High-visibility, U.S. Coast Guard (USCG)-approved personal flotation device (PFD) (if working on any water vessel or without fall protection within 10 feet of water)
	☐	Fall protection meeting OSHA and ANSI Z3591 standards (only when accessing Aerated Stabilization Basin standpipe only)
	☐	USCG-approved float coat and bib-overalls (e.g., full two-piece "Mustang" survival suit or similar) or one-piece survival suit if combined air and water temperature is below 90°F
	☐	Half-face Air-Purifying Respirator (APR) (OSHA/NIOSH-approved)
	☐	Full-face APR (OSHA/NIOSH-approved)
	☐	**Type of Cartridges to be Used**: ☐ **OV or** ☐ **OV/HEPA (if samples are dry)**
• Sediment and soil sample collection and processing	☒	Standard work uniform/coveralls
	☐	Work boots with safety toe conforming to ASTM F2412-05/ASTM F2413-05
	☒	High-visibility traffic safety vest
	☐	Chemical-resistant clothing check appropriate garments: ☐ One-piece coverall ☐ Hooded one- or two-piece chemical splash suit ☐ Disposable chemical coveralls ☐ Chemical-resistant hood and apron ☐ Bib-style overalls and jacket with hood **Fabric Type**: Tyvek NOTE: Thick rain pants and coveralls may be substituted for coated Tyvek if sediments are not obviously contaminated with PAHs or related petroleum products. Rain slickers cannot be effectively decontaminated of tar/petroleum contamination.
	☐	Disposable inner gloves (latex or equivalent "surgical")
	☒	Disposable chemical-resistant outer gloves **Material Type**: Nitrile
	☒	Chemical-resistant boots with safety toe and steel shank conforming to ASTM F2412-05/ASTM F2413-05 or disposable boot covers for safety toe/work boots **Material Type**: Rubber or leather
	☐	Puncture-resistant shanks in safety shoes conforming to ASTM F2412-05/ASTM F2413-05
	☐	Metatarsal guards conforming to ASTM F2412-05/ASTM F2413-05
	☐	Sleeves to be duct-taped over gloves and pants to be duct-taped over boots

Job Tasks		PPE Requirements
	☐	Splash-proof safety goggles
	☒	Safety glasses
	☒	Hard hat
	☐	Hard hat with face shield
	☒	Hearing protectors (**REQUIRED** if site noise levels are greater than 85 dB based on an 8-hour TWA). **Type:** Ear plugs
	☐	Two-way radio communication (intrinsically safe, if explosive atmosphere is a potential)
	☐	Long cotton underwear
	☒	High-visibility, USCG-approved PFD (if working on any water vessel or without fall protection within 10 feet of water)
	☐	USCG-approved float coat and bib-overalls (e.g., full two-piece "Mustang" survival suit or similar) or one-piece survival suit if combined air and water temperature is below 90°F
	☐	Half-face APR (OSHA/NIOSH-approved)
	☐	Full-face APR (OSHA/NIOSH-approved)
	☐	**Type of Cartridges to be Used:** ☐ **OV or** ☐ **OV/HEPA (if samples are dry)**

5.2 Project Air Monitoring Requirements

Air monitoring is not required for this specific scope of work and known site conditions. If the scope of work changes in a manner which will require air monitoring, the plan will be supplemented and/or a JSA will be developed to cover the change in scope or site conditions.

6 Risk Analysis and Control

The following sections discuss the potential health and safety hazards associated with the field tasks described in the Scope of Work. Controls of these hazards are addressed through the mechanical and physical control measures, use of PPE, monitoring, training, decontamination, emergency response, and safety procedures.

Significant changes in the Scope of Work covered by this HASP must be communicated to the PM and CHSM, and a modification to this HASP must be created as needed (see Section 1.1). Any task conducted beyond those identified in the Scope of Work and this HASP must be evaluated using the Job Safety Analysis (JSA) process prior to conducting the work.

6.1 Job Safety Analysis

Anchor QEA work tasks have been evaluated for their hazards and JSA documents have been developed that detail the chemical, physical, and biological hazards associated with these tasks along with the control measures (e.g., engineering controls, administrative controls, and/or PPE) that will be used to conduct them in a safe manner.

The PM and FL are responsible for identifying work tasks and project site conditions that are beyond the previously developed JSA documents and for communicating such information to the CHSM. The CHSM will provide support, as needed, to the PM and the FL, who will have primary responsibility to develop project-specific JSAs.

The contents of the JSA documents shall be communicated to project personnel during the site orientation meeting and during daily safety meetings when conducting work where the specific JSAs are applicable.

JSA documents applicable to this project are located in Appendix B and include the following field tasks:

- General field activities
- Sediment sampling
- General boating activities
- Decontamination activities
- Sample and laboratory glassware handling
- Investigation-derived waste management
  Sonic drilling

6.1.1 Augmented Job Safety Analysis Process

If significant work tasks are identified during the course of the project that were not previously addressed in the JSA documentation supplied in Appendix B, then a task-specific JSA document must

be developed prior to conducting the work. The PM and FL shall develop this document(s) with input from the CHSM, as needed, and this HASP will be modified to include the JSA document (see Section 1.1 for HASP modification procedures). Project personnel shall be trained on the contents of the developed task-specific JSA prior to its implementation. A copy of the task-specific JSA form used in this process is supplied in Appendix B of this HASP.

6.2 Exposure Routes

Possible routes of exposure to the chemicals potentially encountered on this project include inhalation, dermal contact, and ingestion of dust, mist, gas, vapor, or liquid. Exposure will be minimized by using safe work practices and by wearing the appropriate PPE. A further discussion of PPE requirements is presented in Section 10.

6.2.1 Inhalation

Inhalation of particulates, dust, mist, gas, or vapor during field activities is possible. Whenever possible, work activities will be oriented so that personnel are upwind of the sampling location. An organic vapor monitor (OVM) may be used to monitor ambient air and the breathing zone within the work area for organic compounds.

6.2.2 Dermal Contact

Dermal contact with potentially contaminated soil, sediment, or groundwater during field activities is possible. Direct contact will be minimized by using appropriate PPE and decontamination procedures.

6.2.3 Ingestion

Direct ingestion of contaminants can occur by inhaling airborne dust, mist, or vapors, or by swallowing contaminants trapped in the upper respiratory tract. Indirect ingestion can occur by introducing the contaminants into the mouth by way of food, tobacco, fingers, or other carriers. Although ingestion of contaminants can occur, proper hygiene, decontamination, and contamination reduction procedures should reduce the probability of this route of exposure.

6.3 Chemicals of Concern Profile

Table 6-1 provides a summary profile for the COCs for this project. As available, this profile is based on recent site history and site characterization information. For more detailed and specific information, always refer to the Safety Data Sheet (SDS) or equivalent information for the chemical (see Appendix C).

Table 6-1
Chemicals of Concern Profile

Chemical	Exposure Routes	Symptoms	Target Organs	OSHA PEL	Odor Threshold (ppm)	LEL (%)	Ionization Potential (eV)
PAHs (includes benzo(a)pyrene, chrysene, phenanthrene, fluoranthene, pyrene, acenaphthene, methylnaphthalenes, and anthracene)	Skin, eye, inhalation, and ingestion	Odor thresholds vary. Direct contact or exposure to the vapors may be irritating to the eyes. Direct contact can be highly irritating to the skin and can cause dermatitis. Exposure to high vapor concentrations may cause headaches, nausea, vomiting, and other symptoms. Includes human carcinogens. Reacts with acids and oxidizers; produces acrid smoke and toxic gases when involved in fires or thermal decomposition. Exposure to all routes should be carefully controlled to levels as low as possible. Confirmed Animal Carcinogen.	Eyes and skin	0.2 mg/m^3 TWA	N/A	N/A	Not known

Chemical	Exposure Routes	Symptoms	Target Organs	OSHA PEL	Odor Threshold (ppm)	LEL (%)	Ionization Potential (eV)
Carcinogenic PAHs (cPAHs) (includes benzo(a)anthracene, benzo(k)fluoranthene, dibenzo(a,j)acridine, dibenzo(a,e)pyrene, dibenzo(a,l)pyrene, benzo(b)fluoranthene, benzo(a)pyrene, diben(a,h)anthracene, indeno(1,2,3-cd)pyrene, benzo(j)fluoranthene, diben(a,h)acridine, 7H-dibenzo(c,g) carbazole, and 5-methylchrysene)	Skin, eye, inhalation, and ingestion hazard; thermal decomposition causes toxic fumes	Symptoms of over-exposure include headaches, nausea, vomiting, muscle weakness, and other symptoms. Confirmed Animal Carcinogen; possible Human Cancer Hazard.	Liver, kidneys, and central nervous system	0.2 mg/m^3 TWA	N/A	N/A	Not known
PCBs	Inhalation, skin absorption, ingestion, and skin and/or eye contact	Colorless to light-colored, viscous liquid with a mild hydrocarbon odor. Carcinogenic and affects the liver and reproductive system.	Liver, reproductive system, skin, and eyes	1.0 mg/m^3	N/A	N/A	Not known
Mercury	Inhalation, skin absorption, ingestion, and skin and/or eye contact	Eye and skin irritation; cough, chest pain, dyspnea (breathing difficulty), bronchitis, and pneumonitis; tremor, insomnia, irritability, indecision, headache, and lassitude (weakness or exhaustion); stomatitis and salivation; gastrointestinal disturbance, anorexia, and weight loss; and proteinuria.	Eyes, skin, respiratory system, central nervous system, and kidneys	0.1 mg/m^3	N/A	N/A	N/A

Chemical	Exposure Routes	Symptoms	Target Organs	OSHA PEL	Odor Threshold (ppm)	LEL (%)	Ionization Potential (eV)
Copper	Inhalation, ingestion, and skin and/or eye contact	Mucous membrane and respiratory irritant; conjunctivitis; nausea, vomiting, and abdominal pain. Reacts with acids and oxidizers; copper reactions may release flammable gas (hydrogen).	Liver, kidneys, eyes, skin, and respiratory system	1.0 mg/m^3	N/A	N/A	N/A
Lead	Inhalation, ingestion, and skin and/or eye contact	Weakness, insomnia; loss of appetite, loss of weight and abdominal pain; anemia; tremors; weakness of wrists and ankles; kidney damage; low blood pressure. Incompatible with strong oxidizers, hydrogen peroxide, and acids.	Eyes, gastrointestinal tract, central nervous system, kidneys, blood, and gingival tissue	0.05 mg/m^3	N/A	N/A	N/A
Benzene	Inhalation, ingestion, and skin and/or eye contact	Drowsiness; dizziness; headaches; eye, skin, or respiratory tract irritation; unconsciousness.	Eyes, gastrointestinal tract, blood, bone marrow, reproductive system	1.0 ppm TWA; 5.0 ppm for 15 minutes	1.5 ppm	1.2	9.24
Toluene	Inhalation, ingestion, and skin and/or eye contact	Eye, nose, or throat irritation; dry or cracked skin; headache; dizziness; feeling of being drunk; confusion; anxiety	Liver, kidneys, reproductive system, central nervous system, eyes, respiratory system	200 ppm or 750 mg/m^3 TWA	100 ppm	1.1	8.82
Ethylbenzene	Inhalation, ingestion, and skin and/or eye contact	Eye and throat irritation, vertigo, dizziness	Eyes, skin, respiratory system, central nervous system	100 ppm or 435 mg/m^3 TWA	2.3 ppm	0.8	8.76

Chemical	Exposure Routes	Symptoms	Target Organs	OSHA PEL	Odor Threshold (ppm)	LEL (%)	Ionization Potential (eV)
Xylene	Inhalation, ingestion, and skin and/or eye contact	Headache, dizziness, ataxia, drowsiness, excitement, tremor, unconsciousness.	Central nervous system, eyes, skin	100 ppm or 435 mg/m^3 TWA	1 ppm	1.1	8.56
2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	Inhalation, ingestion, and skin and/or eye contact	Potential carcinogen	Not known	NA	NA	NA	NA

Notes:
Sources: https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1000TABLEZ1
https://www.cdc.gov/niosh/npg/npgsyn-c.html
eV: electron volts
IP: Ionization Potential
LEL: lower-explosive limit
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
OEL: Occupational Exposure Limit (identifies the most restrictive exposure limit; e.g., federal or state OSHA Permissible Exposure Limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV), and/or National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL) for the chemicals of concern.
mg/m^3: milligram per cubic meter
N/A: not applicable
TWA: time-weighted average

7 Site Control and Communications

The primary purposes for site controls are to establish the hazardous area perimeter, reduce migration of contaminants into clean areas, and prevent unauthorized access or exposure to hazardous materials by site personnel and the public. Site control is especially important in emergency situations.

7.1 General Site Control Safety Procedures

The following standard safe work practices apply to all Anchor QEA site personnel and subcontractors and shall be discussed in the safety briefing prior to initiating work on the site:

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited on site except in designated areas.
- Hands and faces must be washed upon leaving the work area and before eating, drinking, chewing gum or tobacco, and smoking.
- A buddy system will be used. Radio, cell phone, or hand signals will be established to maintain communication.
- During site operations, each worker will consider himself/herself as a safety backup to his/her partner.
- Visual contact will be maintained between buddies on site when performing potentially hazardous duties.
- No personnel will be admitted to the site without the proper safety equipment, training, and (if required) medical monitoring certification.
- All personnel must comply with established safety procedures. Any staff member who does not comply with safety policy as established in this HASP may be subject to corrective action, potentially including but not limited to, being reprimanded or immediate dismissal.
- Proper decontamination procedures must be followed before leaving a contaminated work area.

7.2 Work Area Access Control

If work is performed in public areas, the following precautions shall be taken to protect both the site personnel and the public. Access control to the work area will be accomplished using a combination of the following devices and/or methods:

- Fences and/or barricades
- Traffic control devices and/or use of flaggers
- Caution tape
- Other methods to keep the site secure and provide a visual barrier to help keep unauthorized personnel from entering the site and active work areas

7.3 Hazardous Waste Site Work Control Procedures

To prevent contamination from migrating from personnel and equipment, work areas will be clearly specified as an Exclusion Zone/Hot Zone (EZ), Contamination Reduction Zone (CRZ), or Support Zone/Clean Zone (SZ) prior to beginning operations. Each work area will be clearly identified using signs or physical barriers. At the end of each workday, the site should be secured and/or guarded to prevent unauthorized entry.

Site work zones will include:

- **Exclusion Zone/Hot Zone (EZ).** The EZ will be the "hot zone" or contaminated area inside the site perimeter (or sample collection area of boat). The EZ is the defined area where potential respiratory and/or health hazards exist. All personnel entering the EZ must use the required PPE, as set forth in this HASP, and meet the appropriate training and medical clearance. Entry to and exit from this zone will be made through a designated point. Appropriate warning signs to identify the EZ should be posted (e.g., DANGER, AUTHORIZED PERSONNEL ONLY, PROTECTIVE EQUIPMENT REQUIRED BEYOND THIS POINT). Personnel and equipment decontamination must be performed upon exiting the EZ.
- **Contamination Reduction Zone (CRZ).** The CRZ, also known as the "warm zone," is a transitional zone between the EZ and the SZ (also known as the "cold zone" or "clean zone"). The CRZ provides a location for removal and decontamination of PPE and tools leaving the EZ. A separate decontamination area will be established for heavy equipment. All personnel and equipment must exit via the CRZ. If the CRZ is compromised at any time, a new CRZ will be established.
- **Support Zone/Clean Zone (SZ).** This uncontaminated zone will be the area outside the EZ and CRZ and within the geographic perimeters of the site (including boat and processing areas). The SZ is used for support personnel; staging materials; parking vehicles; office, laboratory, and sanitation facilities; and receiving deliveries. Personnel entering this zone may include delivery personnel, visitors, security guards, and others who will not necessarily be permitted in the EZ or CRZ.

A log of all personnel visiting, entering, or working on the site shall be maintained by the FL. No visitor will be allowed in the EZ without showing proof of training and medical certification, per 29 CFR 1910.120(e),(f) (and 29 CFR 1926.1101(k)(9),(m) if appropriate). Visitors will attend a site orientation given by the FL and sign the HASP.

7.4 Site-Specific Work Zone Requirements

This section contains guidelines for maintaining safe conditions when working from a boat, in a roadway, or at an excavation site.

7.4.1 Working in a Roadway

Work conducted in public streets may require coordination with local governments and development and submittal of a traffic control plan in accordance with the U.S. Department of Transportation (DOT) Manual on Uniform Traffic Control Devices (MUTCD). Use of personnel qualified as Flaggers may also be required to provide temporary traffic control.

Observe the following site control practices and procedures when working in roadways:

- Plan and conduct work in a manner that traffic may be continuously observed. This may require having a spotter equipped with a noise-making device such as an air horn or a whistle, as appropriate.
- Wear a high-visibility traffic vest and hardhat when a vehicle hazard exists[3]. Include lighted elements when possible in high hazard environments.
- Use cones, flag-mounted cones, caution tape, and/or barricades.
- Protect the work area with a vehicle or piece of heavy equipment if this does not pose an additional hazard. The vehicle should have a strobe light and operating headlights or running lights (if equipped).
- Develop a traffic flow plan for high-traffic situations (as appropriate):
  - Use a flag person
  - Use a flashing arrow sign
  - Use "WORKER AHEAD" signs liberally
  - Obtain lane closing permits
  - Engage police details

See Sections 11.1.12 and 11.1.13 for additional information regarding motor vehicle operation and vehicular traffic.

7.5 Field Communications

Communications between all Anchor QEA employees and subcontractors at the work site can be verbal and/or non-verbal. Verbal communication can be affected by the on-site background noise and various PPE. See Table 7-1 for a list of the types of communication methods and equipment to use, depending on site conditions. Communication equipment must be checked daily to verify proper operation. All project personnel must be initially briefed on the communication methods prior to starting work; communication methods should be reviewed in daily safety meetings.

[3] The 2009 MUTCD (ANSI 107-2004) federal standard for High-Visibility Apparel and Headwear stipulates specific requirements for, among other characteristics, reflectivity of work vests and headwear. This standard must be reviewed and provisions included if work covered by this HASP includes work in controlled roadways.

Table 7-1
Field Communication Methods

Type of Communication	Communication Device	Signal
Emergency notification	On-site Telephone or Cellular Telephone	Initiate phone call using applicable emergency numbers
Emergency notification among site personnel	Two-way Radio	Initiate radio communication with Code Red message
Hailing site personnel for non-emergency	Compressed Air Horn	One long blast, one short blast
Hailing site personnel for emergency evacuation	Compressed Air Horn	Three long, continuous blasts
Hailing site personnel for distress, need help	Visual	Arms waved in circle over head
Hailing site personnel for emergency evacuation	Visual	Arms waved in criss-cross over head
Contaminated air/strong odor	Visual	Hands clutching throat
Break, lunch, end of day	Visual	Two hands together, break apart

8 Decontamination Procedures and Practices

8.1 Minimization of Contamination

The following measures will be observed to prevent or minimize exposure to potentially contaminated materials:

Personnel

- Do not walk through spilled materials.
- Do not handle, touch, or smell sample media directly.
- Make sure PPE has no cuts or tears prior to use.
- Protect and cover any skin injuries.
- Stay upwind of airborne dusts and vapors.
- Do not eat, drink, chew tobacco, or smoke in the work zones.

Sampling Equipment and Vehicles/Vessels

- Use care to avoid getting sampled media on the outside of sample containers.
- If necessary, bag sample containers before filling with sampled media.
- Place clean equipment on a plastic sheet to avoid direct contact with contaminated media.
- Keep contaminated equipment and tools separate from clean equipment and tools.
- Fill sample containers over a plastic tub to contain spillage.
- Clean up spilled material immediately to avoid tracking around the vehicle/vessel.

8.2 Decontamination Equipment

All vehicles, vessels, and equipment that have entered potentially contaminated areas will be visually inspected and, if necessary, decontaminated prior to leaving the area. If the level of vehicle contamination is low, decontamination may be limited to rinsing tires and wheel wells with an appropriate detergent and water. If the vehicle is significantly contaminated, steam cleaning or pressure washing may be required. Tools will be cleaned in the same manner. Rinsate from all decontamination activities will be collected for proper disposal. Decontamination of equipment and tools will take place within the CRZ.

The following supplies will be available to perform decontamination activities:

- Wash and rinse buckets
- Tap water and phosphate-free detergent
- Scrub brushes
- Distilled/deionized water
- Deck pump with pressurized freshwater hose (aboard the vessel)
- Pressure washer/steam cleaner, if appropriate
- Paper towels and plastic garbage bags

8.3 Personnel Decontamination

The FL will verify that all site personnel are familiar with personnel decontamination procedures as listed below. All personnel wearing PPE in a work area (EZ) must undergo decontamination prior to entering the SZ. Personnel will perform the following decontamination procedures:

- Wash and rinse outer gloves and boots in portable buckets to remove gross contamination.
- If suit is heavily soiled, rinse it off.
- Remove outer gloves; inspect and discard if damaged. Leave inner gloves on. Personnel will remove their outer garment and gloves, dispose of them, and properly label container or drum. Personnel will then decontaminate their hard hats and boots with an aqueous solution of detergent or other appropriate cleaning solution. These items then will be hand-carried to the next station. Remove inner gloves.
- Thoroughly wash hands and face before leaving CRZ.
- Sanitize respirators and place in a clean plastic bag.

8.4 Sampling and Processing Equipment Decontamination

To prevent sample cross-contamination, sampling and processing equipment in contact with soil, sediment, or water samples will undergo the following decontamination procedures when work is completed in the CRZ and prior to additional use:

1. Rinse with potable water and wash with scrub brush.
2. Wash with phosphate-free detergent (Alconox®).
3. Visually inspect the sampler and repeat the scrub and rinse step, if necessary. If scrubbing and rinsing with Alconox® is insufficient to remove visually observable tar-related contamination on equipment, the equipment will be scrubbed and rinsed using hexane (or similar type solution) until all visual signs of contamination are absent.
4. Rinse external sampling equipment with potable water three times prior to use. Rinse homogenizing equipment once with potable water and three times with distilled water prior to and between sample processing.

8.5 Handling of Investigation-Derived Waste

All remaining soil or sediment, fluids used for decontamination of sampling equipment, and sample collection disposable wastes (e.g., gloves, paper towels, foil, or others) will be placed into appropriate containers and staged on site for disposal.

8.5.1 Disposable Personal Protective Equipment

Disposable PPE may include Tyvek suits, inner latex gloves, and respirator cartridges. Dispose of PPE according to the requirements of the client and state and federal agencies.

8.5.2 Non-Disposable Personal Protective Equipment

Non-disposable PPE may include respirators and boots and gloves. When decontaminating respirators, observe the following practices and procedures:

- Wipe out the respirator with a disinfecting pad prior to donning.
- Decontaminate the respirator on site at the close of each day with an approved sanitizing solution.

When decontaminating boots and gloves, observe the following practices and procedures:

- Decontaminate the boots or gloves outside with a solution of detergent and water; rinse with water prior to leaving the site.
- Protect the boots or gloves from exposure by covering with disposable covers such as plastic to minimize required decontamination activities.

8.6 Sanitizing Personal Protective Equipment

Respirators, reusable protective clothing, and other personal articles must not only be decontaminated before being reused, but also sanitized. The insides of masks and clothing become soiled due to exhalation, body oils, and perspiration. Manufacturer's instructions should be used to sanitize respirator masks. If practical, reusable protective clothing should be machine-washed after a thorough decontamination; otherwise, it must be cleaned by hand.

8.7 Emergency Personnel Decontamination

Personnel with medical problems or injuries may also require decontamination. There is the possibility that the decontamination may aggravate or cause more serious health effects. If prompt lifesaving, first aid, and medical treatment are required, decontamination procedures will be omitted. In either case, a member of the site management team will accompany contaminated personnel to the medical facility to advise on matters involving decontamination.

8.8 Containment of Decontamination Fluids

As necessary, spill control measures will be used to contain contaminated runoff that may enter into clean areas. Use plastic sheeting, hay bales, or install a spill control system to prevent spills and contain contaminated water.

8.9 Pressure Washing

The following procedure is required when using high-pressure washing equipment for decontamination purposes:

- Wear modified Level D protection, including a face shield and safety goggles.
- Verify that other personnel are out of the area prior to decontamination.

- Secure the area around the decontamination pad with cones, caution tape, or barricades.
- Verify that safe work practices and precautions are taken to minimize the potential for physical injury from high-pressure water spray. Follow the manufacturer's operating instructions.
- The pressure washer wand must be equipped with a safety release handle.
- Verify that the area is clean after equipment is decontaminated. Barricades, cones, or caution tape must be left in place and secured at all times.

9 Health and Safety Training and Informational Programs

This section describes the health and safety training and informational programs with which Anchor QEA project site personnel must comply. All certifications required in this section are provided in Appendix D and will be kept on internal file.

9.1 Initial Project Site Orientation

Work on all Anchor QEA project sites requires participation in an initial health and safety orientation presented by the PM or FL that will consist of, at a minimum, the following topics:

- A review of the contents of this HASP, including the Scope of Work and associated site hazards and control methods and procedures.
- Provisions of this plan are mandatory for all Anchor QEA personnel assigned to the project.
- Anchor QEA subcontractors are also expected to follow the provisions of this plan unless they have their own HASP that covers their specific activities related to this project and includes the minimum requirements of this HASP.
- All visitors to the work site will also be required to abide by the requirements of this plan.
- Personnel assigned to perform work at the project site, working under the provisions of this HASP, will be required to read the plan and must sign the Health and Safety Plan Acknowledgement Form to confirm that they understand and agree to abide by the provisions of this plan. Personnel not directly affiliated with the project (i.e., visitors) may also be required to sign the Liability Waiver.

9.2 Daily Safety Meetings

Daily safety meetings ("tailgate meetings") make accident prevention a top priority for everyone and reinforce awareness of important accident-prevention techniques. The following daily safety meeting procedures and practices are required:

- Daily safety meetings will be held each morning prior to conducting site activities.
- The Daily Safety Briefing form in Appendix A will be used to document each meeting.
- Copies of the completed Daily Safety Briefing forms will be maintained on site during the course of the project.

9.3 End-of-Day Wellness Checks

Similar to the daily safety meetings, field staff will gather at the end of the day to verify group health and wellness and discuss any near misses that occurred that day. The wellness checks will be recorded on that day's Daily Safety Briefing form.

9.4 Hazardous Waste Operations Training

Personnel working on project sites that present a potential exposure to hazardous wastes or other hazardous substances shall be trained in accordance with the requirements of the 29 CFR 1910.120 (HAZWOPER) regulation. Training requirements will consist of the following:

- Field personnel must complete a minimum of 40 hours of hazardous waste activity instruction.
- Field personnel must complete a minimum of 3 days of supervised field instruction.
- Field personnel assigned to the site will also have received 8 hours of refresher training if the time lapse since their previous training has exceeded 1 year.
- On-site managers and supervisors directly responsible for employees engaged in hazardous waste operations will receive an additional 8 hours of supervisory training.
- Field personnel shall be current in first aid/CPR training offered by the American Red Cross or equivalent.
- Other training may be required depending on the task to be performed (e.g., confined space, excavation/trenching, underground storage tank removal, fall protection, respiratory protection, and hazard communication).

9.5 Transportation Worker Identification Credential

All Anchor QEA field personnel will maintain current Transportation Worker Identification Credential (TWIC) status, pursuant to the Maritime Transportation Security Act of 2002, unless this requirement is waived specifically in writing by relevant property owners.

9.6 Hazard Communication Program

The purpose of hazard communication (Employee Right-to-Know) is to verify that the hazards of all chemicals located at the field project site are communicated to all Anchor QEA personnel and subcontractors according to 29 CFR 1926.59. Refer to the Anchor QEA Hazard Communication Program document for additional information.

Every container of hazardous materials must be labeled by the manufacturer, who must also provide a SDS upon initial order of the product and upon request thereafter. The actual format may differ from company to company (e.g., National Fire Protection Association [NFPA], Hazardous Material Information System [HMIS], or other), but the labels must contain similar types of information. Maintain manufacturer labels if possible. The label may use words or symbols to communicate the following:

- Introduction
- Hazard(s) identification
- Composition/information on ingredients
- First-aid measures

- Fire-fighting measures
- Accidental release response measures
- Handling and storage
- Exposure controls/personal protection
- Physical and chemical properties
- Stability and reactivity properties
- Toxicological properties
- Ecological properties
- Disposal considerations
- Transport considerations
- Regulatory information
- Other information, including at a minimum, label preparation or last revision date

SDS for all chemicals brought onto the site or anticipated to be used on site shall be provided in Appendix C of this HASP. These SDS shall be readily available for reference by site personnel and emergency response personnel.

Hazardous materials received without proper labels shall be set aside and not distributed for use until properly labeled.

If a hazardous chemical is transferred into a portable container (approved safety can), even if for immediate use only, the contents (e.g., acetone or gasoline) of the portable container must be identified.

10 General PPE Requirements

The minimum level of PPE should be selected according to the hazards that may be encountered during site activities in accordance with established U.S. Environmental Protection Agency (EPA) levels of protection (D and C). Only PPE that meets American National Standards Institute (ANSI) standards shall be worn. Site personnel must maintain proficiency in the use and care of PPE. Damaged or defective PPE must be replaced and may not be used. Anchor QEA will provide all necessary PPE for its employees as described in this HASP.

Refer to Section 5 for site-specific job task and level-of-protection requirements.

10.1 Minimum Requirements: Level D Protection

The minimum level of protection on project sites will be Level D protection, which consists of the following equipment:

- Standard work uniform/coveralls
- Work boots with safety toe conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05
- Approved safety glasses or goggles (meets ANSI Z87.1—2010 requirements for eye protection)
- Hard hat (meets ANSI Z89.1—1986 requirements for head protection)
- High-visibility traffic safety vest
- Hearing protection when there are high noise levels

Level D protection will be used only when:

- The atmosphere contains no known hazards
- Work functions preclude splashes, immersions, or the potential for unexpected inhalation of, or contact with, hazardous concentrations of chemicals
- Atmospheric concentrations of contaminants are less than the Permissible Exposure Limit (PEL) and/or Threshold Limit Value (TLV)

10.1.1 Modified Level D Protection Requirements

Depending on the Scope of Work and the potential hazards to be encountered, Level D protection shall be modified to include additional protective equipment such as USCG-approved PFDs, face shields/goggles, chemical-resistant clothing, and disposable gloves of varying materials depending on the chemical substances involved. An upgrade to Modified Level D occurs when there is a possibility that contaminated media can contact the skin or work uniform, or if unique, site-specific hazards exist.

10.2 Respiratory Protection Requirements

Respiratory protection devices may potentially be used for protection against particulates and organic vapors during the course of an Anchor QEA field project. The need for respiratory protection will be determined by air monitoring results and site conditions, and in accordance with Anchor QEA's Respiratory Protection Program (RPP; contact Chris Torell). However, engineering and administrative controls must first be evaluated for use as the primary controls for protection against site respiratory hazards. In the event that engineering and administrative controls are deemed not feasible, respiratory protection will be required.

The remainder of this section is provided as general reference. For projects requiring respiratory protection, this section will be amended as appropriate based on project-specific respiratory hazard analysis.

10.2.1 Level C Protection Requirements

An upgrade to Level C protection occurs when the results of air monitoring reveal that action levels have been exceeded. An upgrade to Level B protection occurs when the results of air monitoring reveal that action levels have been exceeded.

Level C protection, in addition to Level D equipment, involves the use of full-face and/or half-face air-purifying respirators equipped with cartridges of appropriate type for the airborne hazards and National Institute for Occupational Safety and Health (NIOSH) approved.

Level C protection shall be used in the following situations:

- When there is a recognized need for protection against particulates, organic vapors, or other airborne contaminants during the course of the project.
- During activities where product odors or exposure symptoms are noted.

If, during the use of respiratory protection, any unusual odors or other evidence of elevated concentrations of chemicals in the workers' breathing zone is noted, the work shall be stopped, workers shall exit the work area, and the PM and CHSM shall be contacted for instructions.

10.2.2 Cartridge Change-Out Schedule

Cartridge change-out schedule data are subject to updates by manufacturers at any time. The data provided in this section must be verified prior to HASP finalization on a project-specific basis.

Field personnel must understand the limitations of air-purifying respirators and the End-of-Service Life cartridge change-out schedule for the particular type of respirator that will be used. Manufacturer's data has been evaluated for three types of respirators: Scott, MSA, and Survivair.

See Table 10-1 for an OV cartridge change-out schedule for total hydrocarbons and benzene.

Table 10-1
Respirator Cartridge Change-out Schedule

Total Hydrocarbons (Toluene, Ethylbenzene, Xylenes) Air Concentration (ppm)	Change-out Schedule			
	SCOTT642 OV/Acid Gas642 OV642 MPC Cartridges	MSA Ultra Twin GME Cartridge	Survivair Organic Vapor Cartridge 100100	Survivair OV/Acid Gas Cartridge 100300/1053 (includes P-100)
< 150	8 hours	8 hours	8 hours	8 hours
> 150 to 200	8 hours	8 hours	8 hours	8 hours
> 200 to 250	8 hours	8 hours	8 hours	8 hours
> 250	Stop Work	Stop Work	Stop Work	Stop Work
Benzene Air Concentration (ppm)	**SCOTT642 OV/Acid Gas642 OV642 MPC Cartridges**	**MSA Ultra Twin GME Cartridge**	**Survivair Organic Vapor Cartridge 100100**	**Survivair OV/Acid Gas Cartridge 100300/1053 (includes P-100)**
< 10	8 hours	8 hours	8 hours	8 hours
> 10 to 100	8 hours	8 hours	8 hours	7 hours
> 100 to 125	7 hours	7 hours	7 hours	6 hours
> 125	Stop Work	Stop Work	Stop Work	Stop Work

Personnel using a respirator that is not listed above must contact the CHSM to determine the change-out schedule for the particular respirator used. Any questions regarding the site-specific respiratory protection program must be directed to the FL and PM.

All cartridges will be changed a minimum of once daily or more frequently if personnel begin to experience increased inhalation resistance. Cartridges will be changed immediately if breakthrough, a chemical warning property (e.g., eye, nose, or throat irritation or odor), or cartridge end-of-life indicator activation occurs. The FL will review this requirement after monitoring the employee's breathing zone for site contaminants and will revise this schedule as may be necessary to avoid over-exposure.

10.2.3 Level B and A Protection Requirements

An upgrade to Level B or Level A protection occurs when the results of air monitoring reveal that action levels have been exceeded. Anchor QEA employees are not permitted to work in atmospheres requiring Level B or Level A respiratory protection.

10.2.4 Respirator Fit Testing

All Anchor QEA personnel who may be required to wear a negative-pressure, air-purifying respirator in the performance of their work duties shall be fit-tested on an annual basis. Employees who wear a respirator for more than 30 days per year shall be enrolled in a medical monitoring program as detailed in Section 12 of this HASP. See also Anchor QEA's RPP (contact Chris Torell).

Employees shall have the opportunity to handle the respirators and wear them in normal air for a familiarity period prior to fit-testing. On each occasion that employees don a respirator for work purposes, they shall test the piece-to-face seal by use of the following positive and negative pressure tests:

- ***Positive Pressure Test:*** With the exhaust port(s) blocked, the positive pressure of slight exhalation should remain consistent for several seconds.
- ***Negative Pressure Test:*** With the intake ports blocked, the negative pressure of slight inhalation should remain constant for several seconds.

Air-purifying respirators shall not be worn when conditions prevent a seal of the respirator to the wearer. Such conditions may be the growth of a beard, sideburns, a skull cap that projects under the face piece, or temple pieces on glasses. No employee may wear a beard if it interferes with the fit of the respirator. Also, the absence of one or both dentures can seriously affect the fit of a face-piece, and should be worn at all times that respirators are being used.

10.2.5 Respirator Cleaning, Maintenance, and Inspection

All respirators used on site shall be cleaned and maintained in the following manner:

- Remove filters and cartridges.
- Visually inspect face piece and parts, discard faulty items.
- Remove all elastic headbands.
- Remove exhalation cover and inhalation valves.
- Wash, sanitize, and rinse face piece. Wash any parts that were removed separately.
- Dry the mask. Wipe face pieces and valves.
- Disassemble and clean the exhalation valve.
- Visually inspect face piece and all parts for deterioration, distortion, or other faults that might affect the performance of the respirator.
- Replace any questionable or faulty parts.
- Reassemble mask and visually inspect completed assembly.
- Seal mask in plastic bag.

See also Anchor QEA's RPP (contact Chris Torell).

11 Health and Safety Procedures and Practices

In addition to the task-specific JSAs listed in Section 6.1 and presented in Appendix B, this section lists the health and safety procedures and practices applicable to this project. For additional information, consult with the PM.

11.1 Physical Hazards and Controls

11.1.1 General Site Activities

Observe the following general procedures and practices to prevent physical hazards:

- Legible and understandable precautionary labels shall be affixed prominently to containers of potentially contaminated soil, sediment, water, and clothing.
- No food or beverages shall be present or consumed in areas that have the potential to contain COCs and/or contaminated materials or equipment.
- No tobacco products or cosmetics shall be present or used in areas that have the potential to contain COCs and/or contaminated materials or equipment.
- An emergency eyewash unit shall be located immediately adjacent to employees who handle hazardous or corrosive materials, including decontamination fluids. All operations involving the potential for eye injury or splash must have approved eyewash units locally available capable of delivering at least 0.4 gallons per minute for at least 15 minutes.
- Personnel working within 10 feet of bodies of water shall wear USCG-approved PFDs.
- Certain project sites may have newly finished work (e.g., concrete, paving, framing, habitat reconstruction, or sediment caps) that may be damaged by unnecessary contact, or that could cause dangerous conditions for personnel (e.g., slipping, sinking, or tripping). Personnel working in or around these areas shall communicate with the PM, FL, and client contact as needed to prevent damaging new work or entering dangerous conditions.
- Generally, all on-site activities will be conducted during daylight hours. If work after dusk is planned or becomes necessary due to an emergency, adequate lighting must be provided.
- Hazardous work, such as handling hazardous materials and heavy loads and operating equipment, should not be conducted during severe storms.
- All temporary electrical power must have a ground-fault circuit interrupter (GFCI) as part of its circuit if the circuit is not part of permanent wiring. All equipment must be suitable and approved for the class of hazard present.

11.1.2 Slips, Trips, and Falls

Observe the following procedures and practices to prevent slips, trips, and falls:

- Inspect each work area for slip, trip, and fall potential prior to each work task.

- Slip, trip, and fall hazards identified must be communicated to all personnel. Hazards identified shall be corrected or labeled with warning signs to be avoided.
- All personnel must be aware of their surroundings and maintain constant communication with each other at all times.

11.1.3 Ergonomic Considerations

Certain field tasks may involve workers in fixed positions (e.g., observing subcontractor work) or performing repetitive motions over a period of time (e.g., sediment sample processing). It is important that workers self-monitor for ergonomic fatigue (e.g., soreness, tightness, stiffness, or pain in muscles) and make adjustments to work tasks, body positions, or work areas so that ergonomic stressors are minimized. Suggestions for decreasing the likelihood of ergonomic stress include the following:

- Limit fixed positions. Periodically vary standing and sitting positions, take frequent short walks, and modify observation locations when possible.
- Minimize extreme postures. Conduct work tasks using comfortable postures (particularly if the tasks are repetitive), and use tools or structures to minimize the need to hold or work with materials or access the work area.
- Limit contact stress. Be aware of soft tissue resting on hard surfaces, and limit these occurrences (e.g., use comfortable footwear, and use tools to hold materials).
- Contact the Field Mobilization Team in advance for prolonged field efforts that involve a field trailer. This group can set up field staff with a monitor, mouse, and keyboard so they are not working solely on laptops.
- Take breaks from work tasks, particularly repetitive ones.
- Consider performing stretching exercises before and during work activities, if those tasks are anticipated to be long in duration and/or strenuous.

11.1.4 Sediment Core Sampling

Sediment samples will be collected using a "Mud Mole" or vibracore sampling equipment operated from a boat. Please see Sections 11.1.15 and 11.1.16 for additional safety information regarding working on or near the water.

All operations involving the use of powered sediment coring rigs will follow generally accepted drilling/coring practices. One person will be assigned the responsibility of Lead Driller/Corer. Additional personnel will assist with equipment as needed. The Lead Driller/Corer will be responsible for operating the drilling/coring rig and ensuring safety.

General rules associated with drilling/coring rig operations will be as follows:

- While drilling, all non-essential personnel shall remain at a distance that is past the radius of any moving parts.
- All operators and team members will be familiar with the rig operations and will have received practical training.
- All personnel will be instructed in the use of the emergency kill switch/shutdown on the drill rig.
- No loose-fitting clothing, jewelry, or free long hair is permitted near the drilling rig or moving machinery parts.
- A first aid kit and fire extinguisher will be available at all times.
- No drilling will occur during impending electrical storms or tornadoes, or when rain, ice, snow, or wind conditions create undue potential hazards.
- Never allow "horsing around" within the vicinity of the drill rig and tool and supply storage areas, even when the drill rig is shut down.

11.1.5 Subsurface Soil Drilling

Subsurface samples will be collected using a sonic drill rig. Please see Sections 11.1.15 and 11.1.16 for additional safety information regarding working on or near the water.

All operations involving the use of powered soil drilling rigs will follow generally accepted drilling practices. One person will be assigned the responsibility of Lead Driller. Additional personnel will assist with equipment as needed. The Lead Driller/ will be responsible for operating the drilling rig and ensuring safety.

General rules associated with drilling/coring rig operations will be as follows:

- While drilling, all non-essential personnel shall remain at a distance that is past the radius of any moving parts.
- All operators and team members will be familiar with the rig operations and will have received practical training.
- All personnel will be instructed in the use of the emergency kill switch/shutdown on the drill rig.
- Hard-hats, steel-toed boots conforming to ASTM F2412-05/ASTM F2413-05, goggles or safety glasses with side shields, hearing protection, and gloves for hand protection are required.
- No loose-fitting clothing, jewelry, or free long hair is permitted near the drilling rig or moving machinery parts.
- A first aid kit and fire extinguisher will be available at all times.
- No drilling will occur during impending electrical storms or tornadoes, or when rain, ice, snow, or wind conditions create undue potential hazards.

- The driller will not attempt to reach a well or borehole location in a manner that compromises the safety of the rig or team.
- All well or borehole locations will be inspected by the drill team to verify that a stable surface exists.
- Adequately cover or protect all unattended boreholes to prevent drill rig personnel or site visitors from stepping or falling into the borehole.
- Never allow "horsing around" within the vicinity of the drill rig and tool and supply storage areas, even when the drill rig is shut down.

11.1.6 Underground or Overhead Utility Line Contact Prevention

Observe the following underground/overhead utility line contact prevention procedures and practices:

- Prior to conducting work, the PM or FL shall verify that all existing underground or overhead utilities in the work area are located per the state or local mark-out methods and subcontract. Documentation of utility mark-out shall be completed using the Utility Contact Prevention Checklist form (see Appendix A). No excavation work is to be performed until all utility mark-outs are verified.
- The PM or FL shall conduct a site survey to search for signs of other buried or overhead utilities. The results of such surveys shall be documented on the Utility Mark-out documentation form.
- The property owner or facility operator shall be consulted on the issue of underground utilities. As-built drawings shall be reviewed, when available, to verify that underground utility locations are consistent with the utility location mark-outs. All knowledge of past and present utilities must be evaluated prior to conducting work.
- If on-site subsurface utility locations are in question, a private locating service shall be contacted to verify locations. If the investigation calls for boreholes in an area not covered by the municipal One-Call system, then a private utility locate firm shall be contacted to determine the location of other underground utilities.
- The PM shall have documented verbal contact and an agreement with the fiber optic company for all work within 50 feet of any fiber optic cables.
- **Only non-destructive excavation, such as hand digging or hydro excavation, is permitted within 3 feet of underground high voltage, product, or gas lines.** Once the line is exposed, heavy equipment can be used, but must remain at least 3 feet from the exposed line.
- Elevated superstructures (e.g., drill rig, backhoe, scaffolding, ladders, and cranes) shall remain a distance of 10 feet away from utility lines and 20 feet away from power lines. Distance from utility lines may be adjusted by the FL depending on actual voltage of the lines.
- Overhead utility locations shall be marked with warning tape or flags where equipment has the potential for contacting overhead utilities.

Table 11-1 shows the minimum clearances required for energized overhead electrical lines.

Table 11-1
Overhead Utility Clearance Requirements

Minimum Clearance from Energized Overhead Electric Lines	
Nominal System Voltage	**Minimum Required Clearance**
0 to 50 kV	10 feet
51 to 100 kV	12 feet
101 to 200 kV	15 feet
201 to 300 kV	20 feet
301 to 500 kV	25 feet
501 to 750 kV	35 feet
751 to 1,000 kV	45 feet

Notes:
Whenever equipment operations must be performed closer than 20 feet from overhead power lines, the FL must be notified. When clearance to proceed is received from the FL, the electric utility company must be contacted to turn the power off or physically insulate (protect) the lines if the operation must be performed closer to the power line than is allowed in this table. For voltages not listed on this table, add 0.4 inches per kilovolt (kV) to obtain the safe distance between equipment and power lines.

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11.1.7 Electric Safety

Observe the following procedures and practices to prevent electric shock:

- General
  - Use only appropriately trained and certified electricians to perform tasks related to electrical equipment. A good rule of thumb is to defer any task that would not normally and reasonably be completed by the average public consumer.
  - Each circuit encountered will be considered live until proven otherwise.
  - Only proper tools will be used to test circuits.
  - No wire will be touched until the circuit is determined to be de-energized.
- Extension Cords
  - All extension cords used on any project will be three-pronged.
  - All extension cords will be in good working order.
  - Each extension cord ground will be tested for continuity on at least a quarterly basis and marked to indicate when the inspection occurred.
  - Each extension cord will be visually inspected before each use.
  - If any extension cord is found in disrepair or fails the continuity test, it will be taken out of service.
  - Any extension cord that does not have the grounding pin will be taken out of service and not used.

  - Extension cords will not be used in place of fixed wiring.
  - Extension cords will not be run through holes in walls, ceilings, or floors.
  - Extension cords will not be attached to the surface of any building.
  - No extension cord will be of the "flat wire" type. Every extension cord will have each individual wire insulated and further protected by an outside cover.
  - Be sure to locate extension cords out of traffic areas or, if this is unavoidable, flag cords and protect workers from tripping over them (i.e., use barricades and tape the cord down).
  - Do not stage extension cords or powered equipment in wet areas, to the degree possible. Elevate cords, connections, and equipment out of puddles.
- Power Tools/Plug and Cord Sets
  - Any cord that is cut in a way that exposes insulation will be removed from service.
  - All tools and plug and cord sets will be tested for continuity.
  - If grounding pins are missing, the plug and cord will be removed from service.
  - Any tool or plug and cord set failing the continuity test will be removed from service.
  - All power tools will have three-pronged plugs unless double insulated.
- Ground-fault Circuit Interrupters
  - Each 120-volt electrical wall receptacle providing power to the job site will be protected by a portable GFCI.
  - Each GFCI will be tested quarterly and marked to indicate when the inspection occurred.
  - Each 120-volt, single-phase, 15- and 20-ampere receptacle outlet, including those on generators, will have an approved GFCI.
  - GFCIs will be located in line as close to the piece of equipment as possible.
- Specific
  - If unsure if a task requires specific electrical training, err on the side of caution and contact the PM and FL prior to proceeding.
  - If subsurface work is to be performed, follow the guidelines in Section 11.1.5 and conduct utility locating prior to work and in accordance with local ordinances.
  - If lock out/tag out (LO/TO) procedures are required (i.e., de-energizing machinery or equipment so work may be performed), the equipment owner must provide LO/TO procedures and training. By default, the equipment owner should perform any LO/TO. If it becomes necessary for Anchor QEA personnel to perform LO/TO tasks, contact the PM and FL prior to doing so.
  - Maintain appropriate distance from overhead utilities (see Table 11-1).
  - If unexpected electrical equipment is encountered (i.e., buried wire) assume it is live, stop work, and contact the PM and FL immediately.

- If working in enclosed or restricted areas where electrical hazards may be present, contact a licensed electrician or other suitably trained party to provide barriers, shields, or insulating materials to prevent electric shock.
- If working in areas where electrical hazards are present, verify that conductive clothing and jewelry is replaced with non-conductive clothing, or removed.

11.1.8 Corrosive Material Handling Procedures

Corrosive materials include acids and bases. They are extremely corrosive materials with a variety of uses. Acids include hydrochloric, nitric, and sulfuric acids. Bases include sodium hydroxide. Observe the following procedures when working with corrosive materials:

- Wear gloves and eye-splash protection while using acid dispensed from a small dropper bottle during water sampling.
- Wear a full-face, air-purifying respirator equipped with combination cartridges (organic vapor/acid gas) as well as Tyvek coveralls and nitrile gloves for large volume applications.
- Have an eyewash bottle and/or portable eyewash station on site.
- Do not add anything into a virgin chemical drum, including unused product.
- Avoid mixing strong acids and bases. Consult the CHSM for task-specific evaluation. If mixing is absolutely necessary, do it slowly. Avoid vapors or fumes that are generated.
- When diluting acids and bases, add the acid or base to water in small quantities and mix cautiously.

11.1.9 General Falls and Ladder Usage

Observe the following general falls and ladder usage procedures and practices:

- Assess work areas for fall hazards. A fall protection system that meets OSHA and ANSI Z3591 standards must be used if work is conducted 6 feet or more above the surface.
- Use ANSI Type 1A rated ladders.
- Verify that ladders are placed so their rungs, cleats, and steps are parallel, level, and uniformly spaced prior to use.
- Make sure ladder rungs are sturdy and free of cracks.
- Use ladders with secure safety feet.
- Pitch ladders at a 1 horizontal to 4 vertical (1H:4V) ratio.
- Secure ladders at the top or have another person at the bottom to help stabilize it.
- Ladders used to access an upper landing surface shall extend at least 3 feet above the upper landing surface.
- Use non-conductive ladders near electrical wires.
- The top rung of a ladder should not be used as a step.
- Do not carry any object or load that could cause a loss of balance or a fall.

- If a ladder is defective, damaged, or in disrepair (i.e., broken or missing rungs, cleats, or steps; broken or split rails; corroded components; or other faulty or defective components), tag the ladder "Do Not Use" and remove it from service until repaired.

11.1.10 Heavy Equipment Operations

Observe the following heavy equipment operations procedures and practices:

- Wear leather gloves while attaching support members to protect against pinching injuries.
- While working from elevated levels greater than 6 feet, verify that all employees have fall protection that meets OSHA and ANSI Z3591 standards.
- Do not stand under loads that are being raised or lowered with cranes or aerial lifts.
- The subcontractor or Anchor QEA equipment operator must conduct pre-operational inspections of all equipment. In addition, daily inspections will be conducted on the equipment prior to site activities.
- Maintain the appropriate distance from overhead utilities (see Table 11-1):
- Always stay out of the swing radius of all heavy equipment. Always use a spotter during movement of equipment. The spotter and others, as appropriate, shall maintain constant communication with the operator.
- All operators must have adequate training and be qualified to operate the particular heavy equipment unit.
- Conduct a site evaluation to determine proper positioning for the unit. Make sure the surface is level. Cordon off holes, drop-offs, bumps, or weak ground surfaces.
- When using a crane, do not use hands when the load is being lifted or lowered. Use non-conductive tag line to help direct and position the load.
- Never climb a raised platform or stand on the mid-rail or top-rail.
- Tools should always be hung or put into a belt whenever possible

11.1.11 Hand and Power Tools

Observe the following procedures and practices when working with hand and power tools:

- Keep hand tools sharp, clean, oiled, dressed, and not abused.
- Worn tools are dangerous. For example, the "teeth" in a pipe wrench can slip if worn smooth, an adjustable wrench will slip if the jaws are sprung, and hammerheads can fly off loose handles.
- Tools subject to impact (e.g., chisels, star drills, and caulking irons) tend to "mushroom." Keep them dressed to avoid flying spalls, and use tool holders.
- Do not force tools beyond their capacity.
- Flying objects can result from operating almost any power tool, so always warn people in the vicinity and use proper eye protection.

- Each power tool should be examined before use for damaged parts, loose fittings, and frayed or cut electric cords. Tag and return defective tools for repairs. Verify that there is adequate lighting, inspect tools for proper lubrication, and relocate tools or material that could "vibrate into trouble."
- Compressed air must be shut off or the electric cord unplugged before making tool adjustments. Air must be "bled down" before replacement or disconnection.
- Proper guards or shields must be installed on all power tools before issue. Do not use improper tools or tools without guards in place.
- Replace all guards before startup. Remove cranks, keys, or wrenches used in service work.

11.1.12 Motor Vehicle Operation

All drivers are required to have a valid driver's license, and all vehicles must have appropriate state vehicle registration and inspection stickers. **Anchor QEA prohibits the use of hand-held wireless devices while driving any vehicle for business use at any time, for personal use during business hours, and as defined by law**. Additionally, site-specific motor vehicle requirements must be followed, if any.

When driving to, from, and within the job site, be aware of potential hazards including:

- Vehicle accidents
- Distractions
- Fatigue
- Weather and road conditions

To mitigate these hazards, observe the following procedures and practices regarding motor vehicle operation:

- Before leaving, inspect fuel and fluid levels and air pressure in tires, and adjust mirrors and seat positions appropriately.
- Wear a seat belt at all times and make sure that clothing will not interfere with driving.
- Plan your travel route and check maps for directions or discuss with colleagues.
- Clean windows and mirrors as needed throughout the trip.
- Wear sunglasses as needed.
- Fill up when the fuel level is low (not near empty).
- Follow a vehicle maintenance schedule to reduce the possibility of a breakdown while driving.
- Stop driving the vehicle, regardless of the speed (e.g., even 5 miles per hour) or location (e.g., a private road), when the potential of being distracted by conversation exists.
- Using hand-held communication devices (e.g., cell phones) while operating any motor vehicle is prohibited.
- Get adequate rest prior to driving.

- Periodically change your seat position, stretch, open the window, or turn on the radio to stay alert.
- Pull over and rest if you are experiencing drowsiness.
- Check road and weather conditions prior to driving.
- Be prepared to adjust your driving plans if conditions change.
- Travel in daylight hours, if possible.
- Give yourself plenty of time to allow for slowdowns due to construction, accidents, or other unforeseen circumstances.
- Use lights at night and lights and wipers during inclement weather.

11.1.13 Vehicular Traffic

Observe the following procedures and practices regarding vehicular traffic:

- Wear a high-visibility traffic safety vest when vehicle hazards exist.
- Use cones, flags, barricades, and caution tape to define the work area.
- Use a vehicle to block the work area (if conditions allow).
- Engage a police detail for high-traffic situations.
- Always use a spotter in tight or congested areas for material deliveries.
- As necessary, develop traffic control plans and train personnel as flaggers in accordance with the DOT MUTCD and/or local requirements.

See Section 7.4.1 for additional information regarding work in roadways.

11.1.14 Working Near Railways

When working near railways or in rail yards, observe the following procedures and practices:

- Plan work activities well ahead of time, including coordination with the railway owner(s) and operator(s).
- Always assume work near railways requires a permit from the railway owner/operator.
- Maintain emergency rail yard and railway owner/operator contact information at the field location.
- Become cognizant of train signals such as horns and lights, in order to understand potential train activity.
- Follow all railway owner/operator required procedures.
- Plan work activities to minimize time spent adjacent to tracks.
- Expect movement from on-track equipment at any time.
- Before approaching a track, look in both directions. Make sure it's safe to get on or cross the track.
- Never cross a track in front of oncoming traffic.

- When on-track equipment is approaching, stay at least 30 feet from the track while the equipment is passing.
- Watch for protruding structures on passing equipment as well as other hazards.
- Do not stage or store equipment unattended within 30 feet of tracks.
- When rail traffic is approaching, move away from the track, and warn your coworkers of approaching rail traffic.
- Never sit, walk, step, stand, or lie down on rails, including other track components such as switch points, frogs, guard rails, derails, and wheel stops.
- Do not lean on, climb on, or go under any on-track equipment unless your job requires it, in which case do so only after all required safety procedures have been put in place.
- Do not walk between on-track equipment unless they are separated by at least 50 feet.
- Keep at least 30 feet from the end of standing trains, cars, or locomotives. This will allow you time to react safely to any movement of the equipment.
- Avoid being trapped between on-track equipment passing on adjacent tracks.

11.1.15 Boating Operations

The following precautions shall be followed when conducting boating trailer and launch activities:

- Follow the trailer and boat manufacturers' instructions for securing the boat to the trailer.
- Follow the trailer manufacturer's instructions for securing the trailer to the towing vehicle.
- Prohibit site personnel from moving into trailer/vehicle pinch points without advising the vehicle operator.
- Use experienced operators when backing trailers on boat ramps.
- Wear proper work gloves when the possibility of pinching or other injury may be caused by moving or handling large or heavy objects.
- Maintain all equipment in a safe condition.
- Launch boats one at a time to avoid collisions.
- Use a spotter for vehicles backing boats to the launch area.
- Understand and review hand signals.
- Wear boots with non-slip soles when launching boats.
- Wear USCG-approved PFDs when working within 10 feet of the water.
- Keep ropes and lines coiled and stowed to eliminate trip hazards.
- Maintain three-point contact on dock/pier or boat ladders.
- Verify that drain plugs are in place, as present.

The following precautions shall be followed when conducting boating operations:

- Maintain a current boater's license(s) as required.
- Wear USCG-approved PFDs for work activities within 10 feet of the water.

- Obtain and review information regarding dams that may be present in work areas, particularly with regard to "no boating" zones and safety buoys, cables, and warning signage.
- Maintain boat anchorage devices commensurate with anticipate currents, distance to shore, and water depths.
- Provide a floating ring buoy in the immediate boat launch/landing areas with at least 60 feet (18.3 meters) of line for a vessel less than 65 feet (19.8 meters) in length, or 90 feet (27.4 meters) of line for a vessel 65 feet (19.8 meters) or greater in length.
- Step into the center of the boat.
- Keep your weight low when moving on the boat.
- Move slowly and deliberately.
- Steer directly across other boat wakes at a 90-degree angle to avoid capsizing.
- Steer the boat facing forward.
- Watch for floating objects in the water.
- Right-of-way is yielded to vessels on your boat's right, or starboard, and vessels with limited ability to maneuver such as any wind-propelled vessel.

The following precautions shall be followed when working on a boat:

- Observe proper lifting techniques.
- Obey lifting limits (see Section 11.1.17)
- Use mechanical lifting equipment (i.e., pulleys or winches) to move large or awkward loads.
- Wear USCG-approved PFDs for work activities within 10 feet of the water.

The safety-related items listed in Table 11-2 shall be available when conducting boating operations.

Table 11-2
Safety Equipment Specific to In-Water Work

Additional Safety Equipment for Sampling Vessel per U.S. Coast Guard Requirements:	
• Proper vessel registration, numbering, and documentation (registered with state, certificate of vessel registration number displayed, and carrying a valid certificate of number) • USCG-approved personal flotation devices (PFDs; or life jackets) for every person on the sampling vessel (Type III or Type IV are common; Type I, II, III, or V are required). High-visibility required by Anchor QEA. • Appropriate, non-expired, visual distress devices for day and night use from the following: – Three hand-held red flares (day and night), or – One hand-held red flare and two parachute flares (day and night), or – One hand-held orange smoke signal, two floating orange smoke signals (day), and one electric distress light (night only) • Alternate means of propulsion (oars or paddles) • Dewatering device (pump or bailer) • Properly maintained and inspected USCG-approved fire extinguishers (no fixed system = (2) B-1 or (1) B-2 type extinguishers; fixed system = (1) B-1 type extinguisher) • Proper ventilation of gasoline-powered vessels • Sound-producing device (whistle, bell, or horn) • VHF 2-way radio • Proper navigational light display • Throwable life ring with attached line (any vessel larger than 16 feet is required to carry one Type IV [throwable] PFD)	
Additional USCG Recommended Equipment Includes:	
• Extra visual distress signals • Primary and spare anchor • Heaving line • Fenders • First aid kit • Flashlight • Mirror • Searchlight • Sunburn lotion • Tool kit • Spare fuel	• Boat hook • Spare propeller • Mooring line • Food and water • Binoculars • Spare batteries • Sunglasses • Marine hardware • Extra clothing • Spare parts • Pertinent navigational chart(s) and compass

11.1.16 Working Over or Near Water

11.1.16.1 Personal Flotation Devices

PFDs are not required where employees are continuously protected from the hazard of drowning by railings, nets, safety belts, or other applicable provisions.

Type I, II, III or V USCG-approved, high-visibility PFD shall be provided and properly worn by all personnel in the following circumstances:

- On or within 10 feet of water
- On floating pipelines, pontoons, rafts, or stages
- On structures extending over or next to the water, except where guard rails or safety nets are provided for employees
- Working alone at night where there are drowning hazards, regardless of other safeguards provided
- In skiffs, small boats, or launches, unless in an enclosed cabin or cockpit
- Whenever there is a drowning hazard

The following precautions shall be followed when using PFDs:

- Prior to and after each use, the buoyant work vests or life preservers shall be inspected for defects that would alter their strength or buoyancy. Defective devices or devices with less than 13 pounds buoyancy shall be removed from service.
- All PFDs shall be equipped with reflective tape as specified in 46 CFR 25.25-15.
- Thirty-inch USCG-approved ring buoys with at least 150 feet of 600-pound capacity line shall be provided and readily available for emergency rescue operations. The distance between ring buoys shall not exceed 200 feet.
- PFD lights conforming to 46 CFR 161.012 shall be required whenever there is a potential need for life rings to be used after dark. Onshore installations, at least one life ring, and every third one thereafter, shall have a PFD light attached. PFD lights on life rings are required only in locations where adequate general lighting (e.g., floodlights or light stanchions) is not provided.

11.1.16.2 Cold Water Work

When the combined air and water temperature is below 90°F, field personnel working on or near water shall wear either a float coat and bib overalls (e.g., a full two-piece "Mustang" survival suit or similar) or a one-piece survival suit. Suits or float coats shall be USCG approved. If extremely cold or severe weather conditions are forecast, work activities should be postponed. Work activities will be continually reviewed and adjustments made if wearing a survival suit during work activities potentially poses a hazard due to warm air temperatures, or limited mobility or agility. In addition, proximity of water work to shore and scope/duration/timing of work activities will be considered when stipulating the above requirement. Overall, if water craft will be used during work, or work will be conducted near water, it is imperative that site-specific conditions are considered and evaluated so that proper safeguards and procedures are in place prior to beginning work.

In addition to considering the use of apparel appropriate for anticipated air, weather, and water conditions, field teams shall identify any procedures necessary for cold-water "man-overboard" scenarios. These procedures should be identified in the site-specific HASP, described in the JSA used for boating activities and, if prudent, practiced before work.

11.1.17 Lifting and Material Handling

Observe the following procedures and practices for lifting and material handling:

- Use leather gloves when handling metal, wire rope, sharp debris, or transporting materials (e.g., wood, piping, or drums).
- The size, shape, and weight of the object to be lifted must first be considered. No individual employee is permitted to lift any object that weighs more than 60 pounds. Multiple employees or mechanical lifting devices are required for objects heavier than the 60-pound limit.
- Plan a lift before doing it. Bend at the knees and lift with the legs; maintain the natural curves of the back; do not use back muscles.
- Check the planned route for clearance.
- Use the buddy system when lifting heavy or awkward objects.
- Do not twist your body while lifting.
- Know the capacity of any handling device (e.g., crane, forklift, chain fall, or come-along) that you intend to use.
- Use tag lines to control loads.
- Verify that your body, material, tools, and equipment are safe from such unexpected movement as falling, slipping, rolling, tripping, bowing, or any other uncontrolled motion.
- Trucks (i.e., flat beds) hauling equipment or materials must not be moved once rigging has been released.
- Chock all material and equipment (such as pipe, drums, tanks, reels, trailers, and wagons) as necessary to prevent rolling.
- Tie down all light, large-surface-area material that might be moved by the wind.
- When working at heights, secure tools, equipment, and wrenches against falling.
- Do not store materials or tools on ducts, lighting fixtures, beam flanges, hung ceilings, or similar elevated locations.
- Fuel-powered tools used inside buildings or enclosures shall be vented and checked for excessive noise.

11.1.18 Noise

Excessive noise is hazardous not only because of its potential to damage hearing, but also because of its potential to disrupt communications and instructions. The following procedures and practices shall be followed to prevent noise-related hazards:

- All employees will have access to ear protection with a Noise Reduction Rating of not less than 30.
- Ear protection must be worn in any environment where site personnel must raise their voices to be heard while standing at a distance of 3 feet or less.
- Ear protection must be worn by any personnel observing or operating concrete cutting or sawing equipment, pile driving, or other loud noise-generating activities.

Hearing protection is required for site personnel operating or working near noisy equipment or operations, where the noise level is greater than 85 A-weighted decibels (dbA) (time-weighted average [TWA]), as well as personnel working around heavy equipment. The FL will determine the need and appropriate testing procedures, (i.e., sound level meter and/or dosimeter) for noise measurement.

When needed, a sound level meter will be used to measure noise levels at selected locations in the work area and on the site perimeter. When used, noise monitoring equipment must be calibrated before and after each shift.

If continuous noise levels are found to exceed 85 dbA at any location within the work area, warning signs will be posted. Site personnel and visitors will be notified that hearing protection is required. Appropriate hearing protection (i.e., ear plugs or ear muffs) will be worn whenever personnel or visitors are working in that location. A supply of ear plugs will be maintained on site.

Action levels in Table 11-3 will trigger the use of appropriate hearing protection (plugs or muffs). Hearing protection must be able to attenuate noise below 90 dbA (8-hour TWA). Each hearing protection or device has a Noise Reduction Rating (NRR) assigned by EPA. The calculation for a hearing protection device's effectiveness is:

Equation 1

Noise reading $dbA - (NNR - 7db) < 90dbA$

where:

dbA	=	A-weighted decibel
NRR	=	Noise Reduction Rating

Table 11-3
Noise Exposure Action Levels

Instrument	Measurement	Action
Type I or Type II Sound Level Meter or Dosimeter	> 80 dbA to 85 dbA	Hearing protection recommended. Limit work duration to 8-hour shifts.
	> 85 dbA to 90 dbA	Hearing protection required. Limit work duration to 8-hour shifts.
	> 90 dbA to 115 dbA	Hearing protection required. Investigate use of engineering controls. Limit work duration to 8-hour shifts.
	> 115 dbA	Stop work. Consult CHSM.

11.1.19 Fire Control

Observe the following fire control procedures and practices:

- Smoke only in designated areas.
- Keep flammable liquids in closed containers.
- Keep the work site clean; avoid accumulating combustible debris such as paper.
- Obtain and follow property owner hot work safety procedures when welding or performing other activities requiring an open flame.
- Isolate flammable and combustible materials from ignition sources.
- Verify fire safety integrity of equipment installations according to National Electrical Code (NEC) specifications.

11.1.20 Static Electricity and Transfer of Flammable Liquids

Observe the following procedures and practices regarding static electricity when transferring flammable liquids:

- Electrically bond and ground pumps, transfer vessels, tanks, drums, bailers, and probes when moving flammable liquids.
- Electrically bond and ground vacuum trucks and the tanks they are emptying.
- Do not splash fill containers with flammable liquids.
- Pour flammable liquids slowly and carefully.
- Two fire extinguishers (2A20:BC) must be available, charged, inspected, and readily accessible.

11.1.21 Cleaning Equipment

Observe the following procedures and practices when cleaning equipment:

- Wear appropriate PPE to avoid skin and eye contact with isopropyl alcohol, Alconox®, or other cleaning materials.
- Stand upwind to minimize any potential inhalation exposure.
- Dispose of spent cleaning solutions and rinses accordingly.

11.2 Environmental Hazards and Controls

11.2.1 Fatigue Management

Because Anchor QEA personnel may be working during both daytime and nighttime hours several days per week, depending on the activity, it is important that all personnel are aware of the hazards related to fatigue. Fatigue can be defined as an increasing difficulty in performing physical or mental activities. Signs of fatigue may include tiredness, changes in behavior, loss of energy, and reduced ability to concentrate. Fatigued site personnel may have a reduced ability to recognize or avoid risks on the work site, which may lead to an increase in the number and severity of injuries and other incidents. Fatigue can occur at any time when working and may cause safety concerns due to decreased manual dexterity, reaction time, and alertness.

Fatigue results from insufficient rest and sleep between activities. Contributing factors to fatigue may include the following:

- The time of day that work takes place
- The length of time spent at work and in work-related duties
- The type and duration of a work task and the environment (e.g., weather conditions and ambient noise) in which it is performed
- The quantity and quality of rest obtained prior to, during, and after a work period
- Non-work activities
- Individual factors such as sleeping disorders, medications, or emotional state

Personnel suffering from fatigue may exhibit both physical and mental effects, such as the following:

- Slower movements
- Poor coordination
- Slower response time to interaction
- Bloodshot eyes
- Slumped or weary appearance
- Nodding off
- Distractedness or poor concentration
- Inability to complete tasks
- Fixed gaze
- Appearing depressed, irritable, frustrated, or disinterested

Employees are strongly encouraged to get sufficient pre-work rest, maintain sufficient nutritional intake during work (i.e., eat and drink at regular intervals), and communicate with team members and leaders if their level of fatigue elevates.

Use the following procedures to help detect and address fatigue-related issues:

- Periodically observe and query coworkers for signs or symptoms of fatigue.
- Site personnel that express concern over their level of fatigue, or that are observed to be fatigued such that elevated worker risk is evident, will be relieved or their work tasks adjusted so that they may rest sufficiently.
- Work schedules will consider fatigue factors and optimize continuous periods available for uninterrupted sleep. The employee is responsible for reporting to work properly rested and fit for duty. In case of an emergency or operational difficulties (e.g., limited access due to water levels or boat repairs), work hours may require adjustment.
- Maintain a routine exercise program and regular sleep schedule as much as possible over the course of the work.
- Avoid heavy meals or caffeine and minimize or eliminate the consumption of alcohol and nicotine before sleeping.

11.2.2 Heat Stress

Observe the following general procedures and practices regarding heat stress:

- Increase the number of rest breaks and/or rotate site personnel in shorter work shifts.
- Watch for signs and symptoms of heat stress and fatigue (see Section 11.2.2.1).
- During hot months, plan work for early morning or evening.
- Use ice vests when necessary.
- Rest in cool, dry areas.
- Verify that employees have access to potable drinking water and shade.
- During conditions exceeding 95°F, verify that the following additional procedures are adhered to:
  - Establish effective communication by voice, observation, or electronic means.
  - Observe employees for alertness and signs or symptoms of heat illness.
  - Designate one or more employees on each work site as authorized to call for emergency medical services.
  - Remind employees to drink water throughout the shift.
  - Conduct pre-shift meetings before beginning work to review the high heat procedures, encourage drinking water, and remind employees of their right to take a cool-down rest when necessary.

11.2.2.1 Signs, Symptoms, and Treatment

The FL will be trained in heat stress prevention, including the following, prior to supervising employees:

- Procedures to prevent heat illness.
- Procedures to follow when an employee exhibits symptoms consistent with possible heat illness, including emergency response procedures.

The information provided below addresses these training requirements.

Adverse climatic conditions are important considerations in planning and conducting site operations. High ambient temperature can result in health effects ranging from transient heat fatigue, physical discomfort, reduced efficiency, personal illness, and increased accident probability to serious illness or death. Heat stress is of particular concern when chemical protective garments are worn because they prevent evaporative body cooling. Wearing PPE places employees at considerable risk of developing heat stress.

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably one of the most common (and potentially serious) illnesses, regular monitoring and other preventive precautions are vital.

Heat Rash. Heat rash can be caused by continuous exposure to hot and humid air and skin abrasion from sweat-soaked clothing, rubber boots, or impermeable waders. The condition is characterized by a localized red skin rash and reduced sweating. Heat rash reduces the ability to tolerate heat. To treat, keep skin hygienically clean and allow it to dry thoroughly after using chemical protective clothing. Take measures to prevent heat rash by changing clothes often to maximize use of dry garments, or taking frequent breaks to allow doffing of equipment and drying of skin.

Heat Cramps. Heat cramps are caused by profuse perspiration with inadequate electrolytic fluid replacement. This often robs the larger muscle groups (stomach and quadriceps) of blood, which can cause painful muscle spasms and pain in the extremities and abdomen. To treat, move the employee to a cool place and give sips of water or an electrolytic drink. Watch for signs of heat exhaustion or heat stroke.

Heat Exhaustion. Heat exhaustion is a mild form of shock caused by increased stress on various organs to meet increased demand to cool the body. Onset is gradual and symptoms should subside within 1 hour. Symptoms include a weak pulse; shallow breathing; pale, cool, moist skin; profuse sweating; dizziness; and fatigue. To treat, move the employee to a cool place and remove as much clothing as possible. Give sips of water or electrolytic solution and fan the person continuously to remove heat by convection. Do not allow the affected person to become chilled. Treat for shock if necessary.

Heat Stroke. Heat stroke is the most severe form of heat stress; the body must be cooled immediately to prevent severe injury and/or death. ***This is a medical emergency!*** Symptoms include red, hot, dry skin; a body temperature of 105°F or higher; no perspiration; nausea; dizziness and confusion; and a strong, rapid pulse. Because heat stroke is a true medical emergency, transport the individual to a medical facility immediately. Prior to transport, remove as much clothing as possible

and wrap the individual in a sheet soaked with water. Fan the individual vigorously while transporting to help reduce body temperature. If available, apply cold packs under the arms, around the neck, or any other place where they can cool large surface blood vessels. If transportation to a medical facility is delayed, reduce body temperature by immersing the individual in a cool-water bath (however, be careful not to over-chill the individual once body temperature is reduced below 102°F). If this is not possible, keep the individual wrapped in a sheet and continuously douse with water and fan.

11.2.2.2 Prevention

The implementation of preventative measures is the most effective way to limit the effects of heat-related illnesses. During periods of high heat, adequate liquids must be provided to replace lost body fluids. Replacement fluids can be a 0.1% saltwater solution, a commercial mix such as Gatorade, or a combination of these with fresh water. The replacement fluid temperature should be kept cool, 50°F to 60°F, and should be placed close to the work area. Employees must be encouraged to drink more than the amount required to satisfy thirst. Employees should also be encouraged to salt their foods more heavily during hot times of the year.

Cooling devices such as vortex tubes or cooling vests can be worn beneath impermeable clothing. If cooling devices are worn, only physiological monitoring will be used to determine work activity.

All site personnel are to rest when any symptoms of heat stress are noticed. Rest breaks are to be taken in a cool, shaded rest area. Employees shall remove chemical protective garments during rest periods and will not be assigned other tasks.

All employees shall be informed of the importance of adequate rest and proper diet, including the harmful effects of excessive alcohol and caffeine consumption.

11.2.2.3 Monitoring

Heat stress monitoring should be performed when employees are working in environments exceeding 90°F ambient air temperature. If employees are wearing impermeable clothing, this monitoring should begin at 77°F. There are two general types of monitoring that the health and safety representative can designate to be used: wet bulb globe temperature (WBGT), and physiological. The Heat Stress Monitoring Record form (see Appendix A) will be used to record the results of heat stress monitoring.

Note that some states such as Washington and California have specific regulatory standards for protection of employees from heat stress-related injuries.

Wet Bulb Globe Temperature (WBGT). The WBGT index is the simplest and most suitable technique to measure the environmental factors that most nearly correlate with core body

temperature and other physiological responses to heat. When WBGT exceeds 25°C (77°F), the work regiment in Table 11-4 should be followed.

Table 11-4
Permissible Heat Exposure Threshold Limit Values

Work/Rest Regimen	Workload		
	Light	Moderate	Heavy
Continuous work	86°F (30.0°C)	80°F (26.7°C)	77°F (25.0°C)
75% work, 25% rest each hour	87°F (30.6°C)	82°F (28.0°C)	78°F (25.9°C)
50% work, 50% rest, each hour	89°F (31.4°C)	85°F (29.4°C)	82°F (27.9°C)
25% work, 75% rest, each hour	90°F (32.2°C)	88°F (31.1°C)	86°F (30.0°C)
These TLVs assume that nearly all acclimated, fully-clothed site personnel with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 100.4°F (38°C).			

(From OSHA Technical Manual, Section III: Chapter 4 - Heat Stress)

The TLVs denoted in Table 11-2 apply to physically fit and acclimatized individuals wearing light, summer clothing. If heavier clothing that impedes sweat or has a higher insulation value is required, the permissible heat exposure TLVs should be adjusted based on the WBGT Correction Factors in Table 11-5.

Table 11-5
WBGT Correction Factors

Clothing Type	WBGT Correction
Summer lightweight working clothing	0°F (0°C)
Cotton coveralls	-3.6°F (-2°C)
Winter work clothing	-7.2°F (-4°C)
Water barrier, permeable	-10.8°F (-6°C)
Fully encapsulating	-14.4°F (-10°C)

Physiological. Physiological monitoring can be used in lieu of, or in addition to, WBGT. This monitoring can be self-performed once the health and safety representative demonstrates appropriate techniques to affected employees. Because individuals vary in their susceptibility to heat, this type of monitoring has its advantages. The following two parameters are to be monitored at the beginning of each rest period:

- **Heart Rate:** The maximum heart rate (MHR) is the amount of work (beats) per minute a healthy person's heart can be expected to safely deliver. Each individual will count his/her

radial (wrist) pulse for 1 minute as early as possible during each rest period. If the heart rate of any individual exceeds 75% of his/her calculated MHR (MHR = 200 - age) at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain the same. An individual is not permitted to return to work until his/her sustained heart rate is below 75% of his/her calculated MHR.

- **Temperature:** Each individual will measure his/her temperature with a thermometer for 1 minute as early as possible in the first rest period. If the temperature exceeds 99.6°F at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain the same. An individual is not permitted to return to work if his/her temperature exceeds 100.4°F.

11.2.2.4 Training

Employees potentially exposed to heat stress conditions will be instructed on the contents of this procedure. This training can be conducted during daily tailgate safety meetings.

11.2.3 Cold Stress

Observe the following procedures and practices regarding cold stress:

- Take breaks in heated shelters when working in extremely cold temperatures.
- Upon entering the shelter, remove the outer layer of clothing and loosen other layers to promote evaporation of perspiration.
- Drink warm liquids to reduce the susceptibility to cold stress.
- Be aware of cold stress symptoms, including shivering, numbness in the extremities, and sluggishness.
- Provide adequate insulating dry clothing to maintain warmth if work is performed in air temperature below 40°F. Wind chill cooling rates and the cooling power of air are critical factors. The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required.
- If the air temperature is 32°F or less, hands should be protected.
- If only light work is involved and if the clothing on the worker may become wet on the job site, the outer layer of the clothing in use should be impermeable to water. With more severe work under such conditions, the outer layer should be water repellent, and the outer wear should be changed as it becomes wetted. The outer garments should include provisions for easy ventilation in order to prevent wetting of the inner layer by sweat.
- If available clothing does not give adequate protection to prevent cold injury, work should be modified or suspended until adequate clothing is made available, or until weather conditions improve.
- Implement a buddy system in which site personnel are responsible for observing fellow workers for early signs and symptoms of cold stress.

11.2.3.1 Signs, Symptoms, and Treatment

Cold stress can range from frostbite to hypothermia. The signs and symptoms of cold stress are listed below. The appropriate guidelines should be followed if any personnel exhibit these symptoms:

Frostbite. Frostbite is characterized by pain in the extremities and loss of manual dexterity. "Frostnip," or reddening of the tissue, is accompanied by a tingling or loss of sensation in the extremities and continuous shivering.

Hypothermia. Hypothermia is characterized by pain in the extremities and loss of manual dexterity, with severe, uncontrollable shivering, and an inability to maintain the level of activity. Symptoms include excessive fatigue, drowsiness, irritability, or euphoria. Severe hypothermia includes clouded consciousness, low blood pressure, pupil dilation, cessation of shivering, unconsciousness, and possible death.

Move the individual to a warm, dry place. If the individual's clothing is wet, remove it and replace it with dry clothing. Keep the individual warm. Re-warming of the individual should be gradual to avoid stroke symptoms. Dehydration, or the loss of body fluids, may result in a cold injury due to a significant change in blood flow to the extremities. If the individual is conscious and alert, warm sweet liquids should be provided. Coffee and other caffeinated liquids should be avoided because of diuretic and circulatory effects. Extremities affected by frostbite should be gradually warmed up and returned to normal temperature. Moist compresses should be applied; begin with lukewarm compresses and slowly increase the temperature as changes in skin temperature are detected. Keep the individual warm and calm and move them to a medical facility as soon as possible.

11.2.4 Sunlight and Ultraviolet Exposure

Observe the following procedures and practices regarding ultraviolet (UV) exposure:

- Protect against extended exposure to sunlight with shade, long clothing, sunscreen, and high-SPF, broad-spectrum sunscreen applied frequently.
- Plan work to avoid unnecessary UV exposure (see Section 11.2.4.2).
- During peak daylight months, plan work for early morning or evening.
- Many factors affect the hazards associated with UV exposure, including the following:
  - **Time of day:** UV rays are strongest between 10:00 a.m. and 4:00 p.m.
  - **Season of the year:** UV rays are stronger during spring and summer months. This is less of a factor near the equator.
  - **Distance from the equator (latitude):** UV exposure goes down as you get farther from the equator.
  - **Altitude:** More UV rays reach the ground at higher elevations.
  - **Cloud cover:** The effect of clouds can vary. Sometimes cloud cover blocks some UV from the sun and lowers UV exposure, while some types of clouds can reflect UV and

increase UV exposure. What is important to know is that UV rays can get through, even on a cloudy day.

  - **Reflection off surfaces:** UV rays can bounce off surfaces like water, sand, snow, pavement, or grass, leading to an increase in UV exposure.
- Cloud cover does not necessarily protect from UV exposure. Consider monitoring the UV index for your work area: http://www2.epa.gov/sunwise/uv-index.
- Evaluate site-specific factors affecting UV exposure and address work practices as appropriate.

11.2.4.1 Signs, Symptoms, and Treatment

The best way to treat sunburn is to prevent it using the guidelines listed in the bullets above and in Section 11.2.4.2. Signs of sunburn include the following:

- Pinkness or redness
- Skin that feels warm or hot to the touch
- Pain, tenderness, or itching
- Swelling
- Small, fluid-filled blisters, which may break
- Headache, fever, chills, and fatigue if the sunburn is severe

If signs of sunburn are noticed, avoid further exposure and immediately implement treatment. If the sunburn is blistering *and* covers 15% or more of the body, seek medical attention.

11.2.4.2 Prevention

UV exposure hazards and their impacts on each worksite should be evaluated to determine the best practices for risk mitigation. The most effective way to prevent skin damage from UV exposure is to protect bare skin from the exposure. This can be accomplished with shade, clothing (e.g., pants, long sleeves, or hats), sunscreen, and sunglasses. Plan work to either create shade or take advantage of natural shade, and avoid peak UV times during the day when possible.

11.2.5 Inclement Weather

Observe the following procedures and practices regarding inclement weather:

- Evaluate the worksite for hazards that may be amplified during inclement weather, such as traction issues, ingress and egress, slope stability, or wind-driven hazards (e.g., dust, debris, or falling trees).
- Stop outdoor work during electrical storms (lightning strikes), hailstorms, high winds, and other extreme weather conditions such as extreme heat or cold.
- Take cover indoors or in a vehicle that will provide adequate protection. In some cases, this may require exiting the worksite, such as during windstorms in areas with overhead hazards (e.g., trees or power lines).

- Listen to local forecasts for warnings about specific weather hazards such as tornadoes, hurricanes, and flash floods.
- Verify that on-site equipment and resources are adequately protected from inclement weather.
- If working in an unfamiliar geographic location, consult with local resources for unique weather hazards.

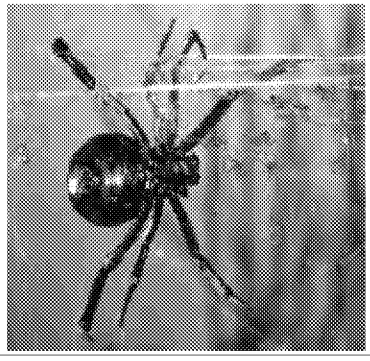
11.2.6 Insects and Spiders

Observe the following general procedures and practices regarding insects/spiders:

- Tuck pants into socks.
- Wear long sleeves.
- Use insect repellent.
- Avoid contact by always looking ahead to where you will be walking, standing, sitting, leaning, grabbing, lifting, or reaching.
- Check for signs of insect/spider bites, such as redness, swelling, and flu-like symptoms.

The most dangerous spiders to humans in North America are black widows and brown spiders (also known as brown recluse or fiddleback spiders). A guide to identifying these spiders is presented in Table 11-6.

Table 11-6
North American Hazardous Spider Identification Guide

Hazardous Spider Identification Guide	
Black Widow Spider • Abdomen usually shows hourglass marking • Female is 3 to 4 centimeters in diameter • Have been found in well casings and flush-mount covers • Not aggressive, but more likely to bite if guarding eggs • Light, local swelling and reddening are early signs of a bite, followed by intense muscular pain, rigidity of the abdomen and legs, difficulty breathing, and nausea • If bitten, see a physician as soon as possible	

11.2.7 Bees and Wasps

Many encounters with bees and wasps occur when nests built in well casings or excavation areas are disturbed. Before opening a well casing, take a few moments to observe whether or not insects are entering or exiting. If they are flying to and from the casing, avoid it if possible. If you must be in an area where disturbing a nest is likely, be sure to wear long pants and a long-sleeved shirt. Stinging

insects fly around the top of their target, so if you get into trouble, pull a portion of your shirt over your head and run away.

If you get stung, look for a stinger and, if present, remove it as soon as possible. Several over-the-counter products or a simple cold compress can be used to alleviate the pain of the sting. If the sting is followed by severe symptoms, or if it occurs in the neck or the mouth, seek medical attention immediately because swelling could cause suffocation.

If you need to destroy a nest, consult with the PM and project FL first. Commercially available stinging insect control aerosols are very effective, but could potentially contaminate the well. Once the nest is destroyed, fine mesh may be applied over the exit and entry points of a well casing to prevent re-infestation.

11.2.8 Ticks

Ticks in North America can be carriers of several diseases, including Lyme's Disease, Rocky Mountain Spotted Fever, and ehrlichiosis.

Limiting exposure to ticks reduces the likelihood of infection when exposed to tick-infested habitats. Measures to prevent tick exposure include the following:

- Remove leaf litter and brush in areas where you will be working prior to tick season.
- Wear light-colored clothing so that ticks are visible.
- Tuck your pant legs into your socks.
- Apply repellents to discourage tick attachment.
- Promptly inspect your body and remove crawling or attached ticks when you leave a tick-infested area.
- Conduct tick checks on buddies upon exiting any suspect area (may be needed multiple times per work day).
- Be aware of seasonal activity; ticks are often most active in the spring.

Observe the following procedures and practices if you are bitten by a tick:

- Use fine-tipped tweezers or shield your fingers with tissue, paper towel, or rubber gloves.
- Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause mouthparts to break off and remain in the skin.
- Do not squeeze, crush, or puncture the body of the tick because its fluids may contain infectious organisms.
- Do not handle the tick with bare hands because infectious agents may enter through mucous membranes or breaks in the skin.

- After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.
- You may wish to save the tick for identification in case you become ill within 2 to 3 weeks. Place the tick in a sealed plastic bag in the freezer, and mark the bag with the date of the bite.

11.2.9 Mosquitoes

Mosquitoes in the United States have been known to carry West Nile virus, Zika virus, St. Louis encephalitis, and Dengue fever. Avoid mosquito bites by doing the following:

- Apply insect repellent containing DEET (N,N-diethyl-meta-toluamide) when outdoors. DEET is very effective, but could potentially contaminate samples.
- Read and follow the product directions whenever you use insect repellent.
- Wear long-sleeved clothes and long pants treated with repellent to further reduce your risk, or stay indoors during peak mosquito feeding hours (dusk until dawn).
- Limit the number of places available for mosquitoes to lay their eggs by eliminating standing water sources from around the work area.
- If you need to destroy a nest, consult with the PM and project FL first.
- Check to see if there is an organized mosquito control program near the project site. If no program exists, work with the local government officials to establish a program.

11.2.10 Bird Droppings

Large populations of roosting birds may present a disease risk. The most serious health risks arise from disease organisms that grow in the accumulations of bird droppings, feathers, and debris under a roost—especially if roosts have been active for years. Among the fungal diseases associated with bird droppings, the two most common are Histoplasmosis and Cryptococcosis.

If you are working in an area where large quantities of droppings are present, follow certain precautions to minimize the risk from disease organisms in the droppings:

- Wear a respirator that can filter particles as small as 0.3 microns, such as a HEPA filter.
- Wear disposable protective gloves, hat, coveralls, and boots if you will be in close contact.
- Wash or shower at the work site after cleanup, if possible.
- If allowable, modify the structure or use methods to prevent birds from re-establishing the roost.

11.2.11 Feral Dogs

Feral (i.e., "wild" or "stray") dogs have been observed at several Anchor QEA job sites. Packs of feral dogs can be dangerous, so if you observe them on the site, call animal control immediately. If a dog approaches you, take the following steps to reduce your chances of being attacked:

- Do not run away or run past the dog.

- Remain calm. If you say anything, speak calmly and firmly. Avoid eye contact. Try to stay still until the dog leaves, or back away slowly until the dog is out of sight. Do not turn and run.
- If you fall to the ground or are knocked down, curl into a ball, placing your hands over your head and neck. Protect your face.

If a dog bites someone, take the following steps:

- Restrain the dog immediately, if it is safe to do so. The dog will have to be quarantined or tested for rabies.
- Check on the victim's condition. Call 911 if paramedic response is required.

11.2.12 Mountain Lions (Cougars), Wolves, and Coyotes

Mountain lions (cougars), gray wolves, and coyotes also have the potential to occur within project sites in North America. Gray wolves are very rare and attacks in the wild are extremely rare. Coyotes are more common, but are rarely seen during the daytime. It is difficult to distinguish between wolves, coyotes, and feral dogs, especially if the light is bad, the sighting is brief, or the animal is far away. Table 11-7 lists the differences in physical appearance between canids. The following practices and procedures should be followed when working in areas that cougars or wolves may inhabit (source: www.bearinfo.org):

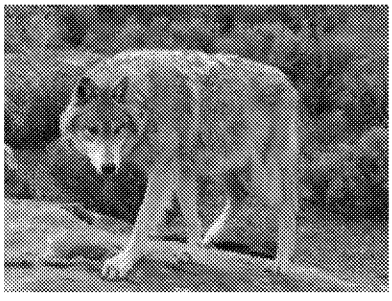
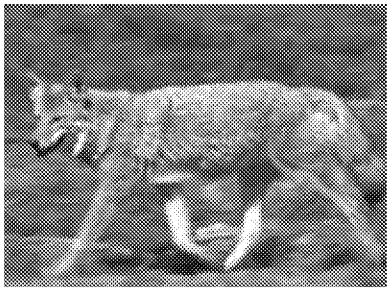
- Hike in groups and make enough noise to avoid surprising a cougar or wolf.
- Do not approach dead animals, especially deer or elk; they could have been cougar or wolf prey left for a later meal.

If you see or encounter a cougar or a wolf:

- Stop immediately and do not run. Running and rapid movements may trigger an attack. At close range, a cougar's instinct is to chase.
- Face the animal. Talk to it firmly while slowly backing away. Always leave the animal an escape route. Do not take your eyes off the animal or turn your back. Do not crouch down or try to hide.
- Try to appear larger than the animal. Get above it (e.g., step up onto a rock or stump). If wearing a jacket, hold it open to further increase your apparent size. If you are in a group, stand shoulder-to-shoulder to appear intimidating.
- In the rare instance that the animal does not flee, be more assertive. If it shows signs of aggression, shout, wave your arms or a stick, and throw anything you have available (water bottle, book, backpack). The idea is to convince the animal that you are not prey, but a potential danger.
- If an animal attacks, fight back. Be aggressive and try to stay on your feet. Cougars and wolves have been driven away by people who have fought back using anything within reach, including sticks, rocks, shovels, backpacks, and clothing—even bare hands. If you are aggressive enough, an animal will flee, realizing it has made a mistake.

- In the case of an aggressive wolf, climb a tree if necessary; wolves cannot climb trees. *Do not use this method for cougars.*

Table 11-7
North American Wolf Identification Guide

Differences in Physical Appearance Between Canids	
Gray Wolf • Color: Black, white, all shades of gray and tan, grizzled, never spotted • Size: 70 to 115 pounds • Height: 26 to 34 inches • Tail carriage: Hangs down or straight, never curls • General appearance: Massive, long legged, first impression is often calf or deer • Ears: Rounded, relatively short, never hang down • Muzzle: Large and blocky	
Coyote • Color: All shades of gray and tan, white or black are very rare, never spotted • Size: 20 to 35 pounds • Height: 16 to 20 inches • Tail carriage: Hangs down or straight, never curls • General appearance: Delicate, medium size, dog-like proportions with fox-like face • Ears: Pointed, relatively long, never hang down • Muzzle: Long and pointed	

Source: http://www.alaska.net/~wolfsong/wolf_id.html

11.2.13 Rodent-Borne Diseases

Rodent infestation on a site has the potential to cause serious communicable diseases including hantavirus pulmonary syndrome and bubonic plague. The most common rodent-borne disease is hantavirus, which may infect workers who inhale tiny droplets containing the virus when fresh rodent urine, droppings, or nesting materials are stirred up.

Working conditions that may put workers at risk of hantavirus include:

- Contact with rodent feces or dried urine, which may mobilize particles of these wastes into the air where they may be inhaled
- Entry into rooms or warehouses that have been closed up and infested for extended periods
- Activities that stir up dust that may mobilize hantavirus

If working in areas of obvious rodent infestation, the CDC recommends the following precautions:

- Do not enter rooms or warehouses that have been closed up unless absolutely necessary.

- If work in closed-up areas or areas with rodent infestation is necessary, contact professional exterminators to eliminate the infestation and clean up the location
- If an exterminator is not available or possible, employees should clean up the infested area using the following steps:
  - When going into outbuildings or rooms that have been closed for an extended period, open them up and air them out before cleaning.
  - Don an air-purifying respirator equipped with HEPA P-100 cartridges and nitrile gloves before cleaning.
  - Do not stir up dust by sweeping or vacuuming droppings, urine, or nesting materials.
  - Thoroughly wet contaminated areas with detergent or liquid to deactivate the virus. Most general-purpose disinfectants and household detergents are effective. However, a hypochlorite solution prepared by mixing 1 and 1/2 cups of household bleach in 1 gallon of water may be used in place of a commercial disinfectant.
  - Once everything is wet, pick up contaminated materials with a damp towel, then mop or sponge the area with disinfectant.
  - Spray dead rodents with disinfectant and flea repellent (to avoid bubonic plague), then double-bag and dispose of in an appropriate waste disposal system. Contact the local or state health department for other disposal methods.
  - Finally, remove respirator and disinfect gloves before taking them off with disinfectant or soap and water. After taking off the clean gloves, thoroughly wash hands with soap and warm water.

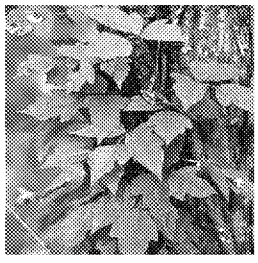
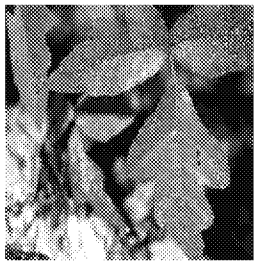
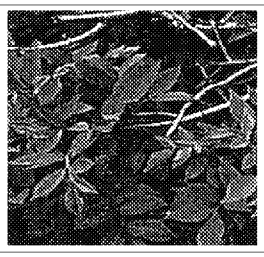
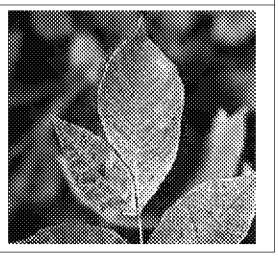
If you experience hantavirus symptoms (fatigue, fever, and muscle aches) within 1 to 5 weeks of exposure to potentially affected rodents and their droppings, contact your supervisor immediately.

11.2.14 Poisonous Plants

Poisonous plants include poison ivy, poison oak, and poison sumac as shown in Table 11-8. Observe the following procedures and practices regarding poisonous plants:

- Avoid entering areas infested with poisonous plants.
- Immediately wash any areas that come into contact with poisonous plants.
- Use PPE when there is a possibility of contact with poisonous plants.

Table 11-8
North American Hazardous Plant Identification Guide

Hazardous Plant Identification Guide		
Poison Ivy • Grows in the West, Midwest, Texas, and the East Coast • Several forms—vine, trailing shrub, or shrub • Three leaflets (can vary from three to nine) • Leaves are green in summer and red in fall • Yellow or green flowers • White berries		
Poison Oak • Grows in the East (New Jersey to Texas) and Pacific Coast • 6-foot tall shrubs or long vines • Oak-like leaves in clusters of three • Yellow berries		
Poison Sumac • Grows in boggy areas, especially in the Southwest and Northern United States • Shrub up to 15 feet tall • Seven to 13 smooth-edged leaflets • Glossy pale yellow or cream-colored berries		

If you have been exposed to poison ivy, oak, or sumac, act quickly because the toxin in the plants penetrates the skin within minutes. If possible, stay outdoors until you complete the first two steps:

1. Cleanse the exposed skin with generous amounts of isopropyl alcohol.
2. Wash the skin with water.
3. Take a regular shower with soap and warm water. Do not use soap until this point because it will pick up the toxin from the surface and move it around.
4. Wash clothes, tools, and anything else that may have been in contact with the toxin with alcohol and water. Be sure to wear hand protection during that process.

Signs and symptoms of exposure include redness and swelling that appears 12 to 48 hours after exposure. Blistering and itching will follow. If you have had a severe reaction in the past, you should see a physician right away. Over-the-counter products that are available to alleviate symptoms include Cortaid®, Lanacort®, baking soda, Aveeno® oatmeal baths, and calamine lotion.

11.2.15 The Public at Large

The community residents around worksites may pose their own specific hazards. These conditions may include the following:

- Unintentional disruption of work
- Benign or malicious trespass
- Criminal intent

Scenarios may include the following:

- Pedestrians, cyclists, or motorists disregarding site boundaries due to distraction or willful disobedience.
- Public use of private site facilities for shelter, relief, and other reasons with no ill-intention.
- Public use of private site facilities for mischievous or criminal activity, such as loitering, vandalism, or theft.
- Encounters with community members who are disgruntled with the project activity.
- Encounters with criminal activities on or near a project site.

If any of the above are anticipated to be likely, take the following precautions as appropriate:

- Verify that the site is adequately marked and barricaded to limit unintentional disruptions of the work by the public.
- Review the site for attractive nuisances (e.g., hazards or conditions that are likely to attract children), and mitigate those.
- Secure all equipment and site facilities to prevent unauthorized access or use.
- Remove valuable items from the site or adequately secure them on site to limit the temptation for potential criminals.
- Have contact information for the client's or owner's public relations office while on site, and direct disgruntled community members to that office. If necessary, vacate the site to relieve the situation and notify the PM or FL.
- Work in pairs when uncertain of the public safety situation at a site. In questionable situations, postpone work as necessary until a plan of action can be developed to verify a safe working environment.

11.2.16 Personal Health and Safety

In addition to hazards associated with chemicals of concern, equipment, operations or site conditions discussed above, there may be additional personal safety issues to consider at a site, including those related to one or multiple protected classes, such as race, gender, religion, ability, sexual orientation,

or gender identity. These conditions may involve the following, perpetrated by the public or those associated with the work:

- Malicious disruption of work
- Harassment, including unwanted comments, gestures, or actions
- Threats of violence, either implied (using derogatory language) or explicit
- Assault

It is critical that the work environment be discussed within the project team to evaluate risks, ways to avoid those risks, and communication protocols. Anchor QEA requires that work be performed in teams.

Specifically, if any of the above are anticipated, take the following precautions as appropriate:

- Alert the PM, FL, CHSM, and Human Resources Department of potential issue(s).
- Formulate a plan of action to verify and maintain a safe working environment prior to field work, which may include the following:
  - Working in pairs and/or within a certain physical distance of other work groups.
  - Coordinated check-ins (calls to or from the office or visual check-ins with other field members).
- Whenever possible, schedule work only within daylight hours (which fluctuate seasonally) or on weekends when questionable scenarios may be more minimal.
  - If night work is required, maintain a minimum of two field personnel at all times, and potentially increase the total number of personnel.
  - If working in high-risk areas, discuss the possibility of hiring security if work needs to be performed at night, in low light, or near potentially dangerous areas (e.g., abandoned buildings, public displays of hostility, discrimination, or gang-related activity).
- Maintain a field phone with active GPS and non-locking 911 capability at all times while out in the field.
- If a need arises for a change in field work (e.g., additional sampling or moving to an area that was not planned) or travel plans (e.g., dead battery or flat tire), immediately alert the FL and PM as to the event.

In addition, practice active awareness of your environment. Discuss personal health and safety concerns at the daily tailgate meeting. If you feel unsafe based on the potential behavior of others, immediately bring it up to field team coworkers. If the issue is not resolved to your satisfaction, alert the PM, FL, CHSM, and Human Resources Department to assist in resolving any potential issue(s).

12 Medical Monitoring Program

This section describes the medical monitoring program that Anchor QEA field personnel must comply with when working on sites where there is a potential for exposure to hazardous wastes or other hazardous substances.

12.1 General Requirements

Anchor QEA employees shall be enrolled in a medical monitoring program in compliance with OSHA standards (29 CFR 1910.120(f)) under the following circumstances.

If they are involved with any of the following operations:

- *Cleanup operations* required by a governmental body, whether federal, state, local, or other involving hazardous substances that are conducted at uncontrolled hazardous waste sites (including, but not limited to, the EPA's National Priority List [NPL] sites, state priority list sites, sites recommended for the EPA NPL, and initial investigation of government-identified sites that are conducted before the presence or absence of hazardous substances has been ascertained)
- *Corrective actions* involving cleanup operations at sites covered by the Resource Conservation and Recovery Act of 1976 (RCRA) as amended (42 United States Code 6901 et seq)
- *Voluntary cleanup operations* at sites recognized by federal, state, local, or other governmental bodies as uncontrolled hazardous waste sites
- *Operations involving hazardous wastes* that are conducted at treatment, storage, and disposal (TSD) facilities regulated by 40 CFR 264 and 40 CFR 265 pursuant to RCRA or by agencies under agreement with the EPA to implement RCRA regulations
- *Emergency response operations* for releases of, or substantial threats of releases of, hazardous substances without regard to the location of the hazard

And, if they meet the following criteria:

- Are or may be exposed to hazardous substances or health hazards at or above the established PEL, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more per year

In addition, employees are required to be enrolled in the medical monitoring program if they meet any of the following conditions:

- Wear a respirator for 30 days or more per year
- Are injured, become ill, or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operations
- Are members of a Hazardous Materials (HAZMAT) team

Anchor QEA employees required to be enrolled in a medical monitoring program under 29 CFR 1910.120(f) shall have medical examinations and consultations made available to them by Anchor QEA on the following schedule:

- Prior to assignment
- At least once every 12 months unless the attending physician believes a longer interval (not greater than biennially) is appropriate
- At termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last 6 months
- As soon as possible upon notification that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or that the employee has been injured or exposed above the PEL or published exposure levels in an emergency situation
- At more frequent times, if the examining physician determines that an increased frequency of examination is medically necessary

The content of medical examinations or consultations made available to employees shall be determined by the attending physician but shall include, at a minimum, a medical and work history with special emphasis on symptoms related to the handling of hazardous substances and health hazards, and to fitness for duty including the ability to wear any required PPE under conditions (i.e., temperature extremes) that may be expected at the work site.

The attending physician shall provide Anchor QEA with a written opinion for each examined employee that contains the following information:

- Whether the employee has any detected medical conditions that would place the employee at an increased risk of impairment of the employee's health from hazardous waste operations work, emergency response, or respirator use
- Any recommended limitations on the employee's assigned work
- A statement that the employee has been informed of the results of the medical examination and any medical conditions that require further examination or treatment

The written opinion obtained by Anchor QEA shall not reveal specific findings or diagnoses unrelated to occupational exposures. Medical monitoring and other employee-related medical records shall be retained for at least the duration of employment plus 30 years.

12.2 Team Self-Monitoring

All personnel will be instructed to look for and inform each other of any deleterious changes in their physical or mental condition during the performance of all field activities. Examples of such changes are as follows:

- Headaches
- Dizziness
- Nausea
- Blurred vision
- Cramps
- Irritation of eyes, skin, or respiratory system
- Skin chafing from damp or wet clothing
- Changes in complexion or skin color
- Changes in apparent motor coordination
- Increased frequency of minor mistakes
- Excessive salivation or changes in papillary response
- Changes in speech ability or speech pattern
- Symptoms of heat stress or heat exhaustion
- Symptoms of hypothermia

If any of these conditions develop, the affected person will be moved from the immediate work location and evaluated. If further assistance is needed, personnel at the local hospital will be notified, and an ambulance will be summoned if the condition is thought to be serious. If the condition is the result of sample collection or processing activities, procedures and/or PPE will be modified to address the problem.

Appendix A
Health and Safety Logs and Forms

Daily Safety Briefing Form

Date: _____

Project No: _____

Project Name: _____

Person Conducting Meeting: _____ **Health & Safety Officer:** _____ **Project Manager:** _____

TOPICS COVERED:

- ☐ Emergency Procedures and Evacuation Route
- ☐ Directions to Hospital
- ☐ HASP Review and Location
- ☐ Safety Equipment Location
- ☐ Proper Safety Equipment Use
- ☐ Employee Right-to-Know/ SDS Location
- ☐ Fire Extinguisher Location
- ☐ Eye Wash Station Location
- ☐ Buddy System
- ☐ Self and Coworker Monitoring
- ☐ Lines of Authority
- ☐ Communication
- ☐ Site Security
- ☐ Vessel Safety Protocols
- ☐ Work Zones
- ☐ Vehicle Safety and Driving/ Road Conditions
- ☐ Equipment Safety and Operation
- ☐ Proper Use of PPE
- ☐ Decontamination Procedures
- ☐ Near Miss Reporting Procedures
- ☐ Lifting Techniques
- ☐ Slips, Trips, and Falls
- ☐ Hazard Exposure Routes
- ☐ Heat and Cold Stress
- ☐ Overhead and Underfoot Hazards
- ☐ Chemical Hazards
- ☐ Flammable Hazards
- ☐ Biological Hazards
- ☐ Eating/Drinking/Smoking
- ☐ Reviewed Prior Lessons Learned
- ☐ Field Team Medical Conditions for Emergency Purposes (Confidential): _____
- ☐ Other: _____

Weather Conditions: _____

Daily Work Scope: _____

Site-specific Hazards: _____

Safety Comments: _____

Attendees

Printed Name	Signature

End of Day Wellness Check

Employee Exposure/Injury Incident/Spill Report

Employee Name: _____ **Date:** _____

Project Name/No: _____ **Time:** _____

Type of Occurrence: ☐ employee exposure ☐ injury incident ☐ spill

Site Name and Location: _____

Site Weather: *(clear, rain, snow, etc.)* _____

Nature of Illness/Injury: _____

Symptoms: _____

Action Taken: ☐ rest ☐ first aid ☐ medical

Transported By: _____ **Witnessed By:** _____

Hospital Name: _____

Treatment: _____

Describe in detail how this exposure/injury incident/spill occurred: *(if a spill, list the name of the compounds, quantities, and method of cleanup/containment)* _____

_____

_____

_____

_____

_____

What was the person doing at the time of the accident/incident?: _____

_____

List personal protective equipment worn: _____

_____

What immediate action was taken to prevent recurrence?: _____

_____

Employee:

_____	_____	_____
Printed Name	Signature	Date

Supervisor:

_____	_____	_____
Printed Name	Signature	Date

Site Safety Representative:

_____	_____	_____
Printed Name	Signature	Date

NOTE: Use additional page(s) if necessary.

Field Safety Equipment Checklist

The following is a list of safety-related gear that may be appropriate depending on the type of work being conducted. The purpose of this checklist is twofold: 1) ensure that all field crew members think about appropriate safety gear needs before heading to the worksite; and 2) provide an extensive list of gear to consider in order to serve as a reminder of potential safety gear needs during a field effort.

☐ **Safety Briefing Log or Notebook**

Personal Protective Gear

- ☐ Rain pants and jacket
- ☐ Hard hats
- ☐ Boots (steel-toed, if appropriate)
- ☐ Safety glasses
- ☐ Ear protection
- ☐ Nitrile gloves (inner and outer pair)
- ☐ Tyvek overalls
- ☐ H_2S sensor
- ☐ Flashlight
- ☐ EpiPen (inquire if any field staff use one)
- ☐ Other:

Warm Weather Safety Gear

- ☐ Sunscreen
- ☐ Water
- ☐ Hat
- ☐ Light clothes

Cold Weather Safety Gear

- ☐ Warm clothes (preferably synthetics)
- ☐ Hat
- ☐ Gloves
- ☐ Boot warmers
- ☐ Thermos of warm drink/soup

Communications

- ☐ Notify office staff of day's field plan
- ☐ Walkie Talkies
- ☐ Cell phones
- ☐ Satellite phone (if appropriate)
- ☐ Contact numbers (e.g., for other field crew members, the PM, or others to notify that you are accessing site)

General Gear for Work Near Water

- ☐ Life jacket
- ☐ Boots or waders (hip or chest)
- ☐ Throwline

Boat Safety Gear

U.S. Coast Guard Required Gear:

- ☐ 1. Personal flotation device (PFD), preferably life jacket, for each occupant
- ☐ 2. Fire extinguisher (filled to operable range)
- ☐ 3. Flares (unexpired)
- ☐ 4. Horn
- ☐ 5. Navigation lights
- ☐ First aid kit
- ☐ Bowline and stern line
- ☐ Anchor and anchor line
- ☐ Paddle
- ☐ Spare propeller and linchpin
- ☐ Appropriate personal protective gear (boots or waders) to step onto shore if necessary
- ☐ Drain plug (and spare)
- ☐ Boat fuel and oil
- ☐ Weather radio (if appropriate)
- ☐ Weather, tides, and currents forecasts
- ☐ Warm clothes/blanket in dry bag

Modification to Health and Safety Plan

Date: _____

Project No: _____

Project Name: _____

Modification: _____

_____

_____

_____

_____

Reason for Modification: _____

_____

_____

_____

_____

_____

Site Personnel Briefed

Name:	_____	**Date:**	_____
Name:	_____	**Date:**	_____
Name:	_____	**Date:**	_____
Name:	_____	**Date:**	_____
Name:	_____	**Date:**	_____
Name:	_____	**Date:**	_____
Name:	_____	**Date:**	_____
Name:	_____	**Date:**	_____
Name:	_____	**Date:**	_____
Name:	_____	**Date:**	_____
Name:	_____	**Date:**	_____

Approvals

Field Lead:	_____	_____	_____
	Printed Name	Signature	Date
Project Manager:	_____	_____	_____
	Printed Name	Signature	Date

Utility Contact Prevention Checklist

NOTE: Utility mark-out requirements vary from state to state; consult state authorities before beginning work.

Purpose: This form is intended to help the Field Lead confirm that underground or overhead utilities are identified to the extent practicable and consistent with applicable regulations **PRIOR** to site work.

INVESTIGATIONS MUST NOT OCCUR UNTIL MULTIPLE LINES OF EVIDENCE INDICATE THAT SUBSURFACE OR OVERHEAD UTILITIES ARE NOT PRESENT IN THE WORK AREA

Project Name/No: _____ **Date:** _____

Field Lead: _____ **Project Address:** _____

Project Manager: _____ **Health & Safety Officer:** _____

Emergency Contact Information for One Call: _____

Duration/Summary of Work to be Performed: _____

Consideration	Check		Explanation	Initial
Has the state One Call been contacted?	☐ Yes	☐ No		
Has the property owner or client been contacted for local knowledge of utilities, as applicable?	☐ Yes	☐ No		
Does the property owner or client have specific utility contact prevention procedures and, if so, have they been completed?	☐ Yes	☐ No		
Are any as-built drawings available? If so, do they show any utilities?	☐ Yes	☐ No		
Has a visual inspection of the work area(s) been completed?	☐ Yes	☐ No		
Has the potential presence of in-water utilities been assessed (shore markers, streets dead-ending at water's edge, etc.)	☐ Yes	☐ No		
Is evidence of electrical utilities present? (electric meters on structures, conduits, overhead lines, light poles, etc.)	☐ Yes	☐ No		
Is evidence of water/sewer utilities present? (water meter, hydrants, restrooms, grates in ground, etc.)	☐ Yes	☐ No		
Is evidence of telecommunications utilities present? (fiber optic warning signs, conduits from utility poles, wall-mounted boxes, etc.)	☐ Yes	☐ No		
Is other evidence of utilities present? (unknown ground markings, manholes or valve covers, "Call Before You Dig" signs, linear asphalt or concrete repair characteristics, liner subsidence of ground surface, pin flags or stakes, etc.)	☐ Yes	☐ No		

Utility Contact Prevention Checklist

NOTE: Utility mark-out requirements vary from state to state; consult state authorities before beginning work.

Consideration	Check		Explanation	Initial
Has a private locating service been contacted?	☐ Yes	☐ No		
Were any utilities identified and marked out through a private locating service? If so, duplicate mark-outs on site drawings.	☐ Yes	☐ No		
Are there any fiber optic cables, fuel lines, or high-pressure lines within 50 feet of work locations?	☐ Yes	☐ No		
If fiber optic cables, fuel lines, or high-pressure lines are within 50 feet, has an agreement with the utility owner been established?	☐ Yes	☐ No		
Can a test borehole be advanced by hand digging, probing, post-hole digging, and/or air knifing to 5 feet below ground surface (bgs)?	☐ Yes	☐ No		
If hand digging, probing, post-hole digging, and/or air knifing to 5 feet bgs is not possible, can a non-invasive geophysical investigation be conducted? If not, why?	☐ Yes	☐ No		
Other considerations:				

NOTE: Please fill in second page and attach additional reports, drawings, or other information, as necessary.

Confirmation Number: _____

Contact Name: _____ **Organization:** _____

Contact Date: _____ **Contact Time:** _____

Response: _____

_____

_____

_____

Completed by:

_____ _____ _____

Printed Name Signature Date

Contractor:

_____ _____ _____

Printed Name Signature Date

PLAYING IT SAFE

Appendix B
Job Safety Analysis (JSA) Documents

Job Safety Analysis

Field Activities

Project Name: Port of Seattle T-25 South Design Characterization	**Project Number:** 160003-03.01	**JSA Number:** 001	**Issue Date:** 1/11/19
Location: Terminal 25 – Port of Seattle	**Contractor:** Anchor QEA, LLC	**Analysis by:** Casey Janisch	**Analysis Date:** 1/06/19
Work Operation: Field activities	**Superintendent/Competent Person:** Field Team	**Revised by:** N/A	**Revised Date:** N/A
Required Personal Protective Equipment (PPE): • Modified Level D—Long pants, long sleeves, and/or Tyvek coveralls if handling potentially contaminated media, and steel-toed footwear conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05 • Depending on activity, the following PPE may also be required: safety glasses/splash goggles, hard hat, nitrile outer gloves and latex inner gloves, and, if boating, U.S. Coast Guard-approved personal flotation device (PFD; see cold stress section for cold-weather PFD information)		**Reviewed by:** Nik Bacher	**Reviewed Date:** 1/10/19
		Approved by: Nik Bacher	**Approved Date:** 1/10/19

Job Safety Analysis

ANCHOR QEA

Field Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
If boating		• Follow the Job Safety Analysis (JSA) for boating activities.	
Outdoor, physical activity	Slips, trips, and falls	• Avoid walking while writing or texting—maintain a heads-up posture. • Be aware of potentially slippery surfaces and tripping hazards. Use handrails where available. Wear footwear that has sufficient traction. • Maintain good housekeeping practices. Clean up all spills immediately. • Be aware of weather effects on the work area, including wet and/or frozen ground. • Jumping, running, and horseplay are prohibited. • Keep all areas clean and free of debris to prevent any trips and falls. • Be aware of and limit loose clothing or untied shoelaces that may contribute to slips, trip, and falls. • Notify the field team members of any unsafe conditions.	• Routinely inspect work area for unsafe conditions.
	Heat stress	• Adjust work schedules, as necessary, to avoid the hottest part of the day. • Take rest breaks as warranted. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.
	Cold stress	• Provide shelter (enclosed, heated environment) to protect personnel during rest periods. • Educate workers to recognize the symptoms of frostbite and hypothermia. • Use appropriate cold-weather gear, up to and including Mustang-type bib coveralls or jacket/bib combinations. • Consider additional precautions if working near water in cold weather. • Have a dry change of clothing available. • Train workers to recognize the symptoms of cold-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions and PPE. • Monitor outside and water temperature versus worker activity and PPE.
	Rain or snow	• Wear appropriate PPE (rain gear). • Be aware of slip hazards, puddles, and electrical hazards when working in wet conditions. • If extremely cold conditions are forecast, consider additional precautions or postponing work activity.	• Review weather forecast prior to field work. • Inspect PPE daily prior to use. • Routinely inspect work area for deteriorating conditions.

Job Safety Analysis

ANCHOR QEA

Field Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Outdoor, physical activity (continued)	Sunshine	• Have sunscreen available for ultraviolet protection. • Have abundant water available to prevent dehydration. • Consider wearing wide-brimmed headwear and light-colored, lightweight, sun-blocking clothing.	• Ensure that sunscreen and water are available.
	Lightning	• Do not begin or continue work until lightning subsides for at least 30 minutes. Disconnect and do not use or touch electronic equipment. • Immediately head for shore if on the water and lightning is observed. If not able to get to shore, disconnect and do not use or touch the major electronic equipment, including the radio, throughout the duration of the storm.	• Obtain weather forecast and updates as needed.
	High winds	• Wear goggles or safety glasses if dust or debris are visible.	• Review weather forecast prior to field work. • Ensure that goggles or safety glasses are available.
	Biological hazards (flora [e.g., poison ivy and poison oak] and fauna [e.g., ticks, bees, spiders, mosquitoes, and snakes])	• Be aware of likely biological hazards in the work area. • Wear appropriate clothing (i.e., hat, long-sleeve shirt, long pants, leather gloves, boots, and Tyvek coveralls, as appropriate), and apply insect repellant. • Wear hand and arm protection when clearing plants or debris from the work area. • Be aware of potential wildlife and defensive behavior (e.g., nesting birds, or animals with young).	• Ensure that insect repellent is available. • Inspect clothing and skin for insects (e.g., ticks) after working in insect-prone areas.
	Noise exposure	• Wear hearing protection in high noise environments or when working around heavy machinery or equipment (action level of 85 decibels averaged over an 8-hour day).	• Ensure that hearing protection is available.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).
- If boating is involved, and a professional captained vessel is not in use, boat operators must take the appropriate state or provincial boater safety courses.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

PLAYING IT SAFE

Job Safety Analysis

Sediment Sampling

Project Name: Port of Seattle T-25 South Design Characterization	**Project Number:** 160003-03.01	**JSA Number:** 002	**Issue Date:** 1/11/19
Location: Terminal 25 – Port of Seattle	**Contractor:** Anchor QEA, LLC	**Analysis by:** Casey Janisch	**Analysis Date:** 1/06/19
Work Operation: Sediment sampling	**Superintendent/Competent Person:** Field Team	**Revised by:** N/A	**Revised Date:** N/A
Required Personal Protective Equipment (PPE): • Modified Level D—Long pants, long sleeves, and/or Tyvek coveralls if handling potentially contaminated media, and steel-toed footwear conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05 • Safety glasses/splash goggles, hard hat, nitrile outer gloves and latex inner gloves, and, if boating, U.S. Coast Guard-approved personal flotation device (PFD; see cold stress section for cold-weather PFD information)		**Reviewed by:** Nik Bacher	**Reviewed Date:** 1/10/19
		Approved by: Nik Bacher	**Approved Date:** 1/10/19

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
If boating		• Follow the Job Safety Analysis (JSA) for boating activities.	
If using glassware		• Follow the JSA for handling glassware.	
Sediment sample retrieval and processing	Injury from hand and power tool operation (e.g., spatula or drill)	• Be aware of sharp edges on hand tools (e.g., spatulas, knives, drill bits, and saw blades). • Be aware of electrical connections and water hazards when working with electric- or battery-operated tools. • Ensure that all tools are working properly; repair or replace defective tools. Repair when unplugged and off. • Keep guards on power tools when not in use.	• Inspect tools to ensure that they are in good working order. • Inspect electrical connections (if applicable). • Inspect tools periodically to ensure dry and clean operation.
	Noise exposure	• Wear hearing protection in high noise environments or when working around heavy machinery or equipment (action level of 85 decibels averaged over an 8-hour day).	• Ensure that hearing protection is available.

Sediment Sampling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Sediment sample retrieval and processing (continued)	Slips, trips, and falls	• Avoid walking while writing or texting—maintain a heads-up posture. • Be aware of potentially slippery surfaces, including boat decks, riprap, muddy or algae-covered rocks, shoreline plants/seaweed, thick mud, and tripping hazards. Use handrails where available. Wear footwear that has sufficient traction. • Maintain good housekeeping practices. Clean up all spills immediately. • Be aware of weather effects on the work area, including wet and/or frozen ground. • Jumping, running, and horseplay are prohibited. • Be cautious when entering or exiting the vessel, and load/unload items onto/off of the pier or shore once boarded. • Keep all areas clean and free of debris to prevent any trips and falls. • Notify the field team members of any unsafe conditions.	• Routinely inspect work area for unsafe conditions.
	Ingestion of contaminants, or skin or eye contact with contaminants	• Wear appropriate PPE to prevent/reduce exposure. • Contact 911, as necessary; perform CPR if breathing stops. • Move exposed person away from source of contamination, and rinse mouth. If exposure to skin occurs, promptly wash contaminated skin using soap or mild detergent and water. Rinse eyes with large amounts of water. • Follow decontamination procedures as outlined in the Health and Safety Plan (HASP).	• Ensure that decontamination procedures are on hand and are reviewed. • Ensure that PPE and rinsing water are available.
	Muscle strain or injuries from improper lifting	• Use proper lifting techniques or ask for assistance with heavy objects. • If boating, avoid carrying objects directly onto or off the boat; rather, load/unload objects while on the boat to/from the pier/shore.	• Evaluate weight and center of gravity of heavier items prior to lifting or moving.
	Pinch points	• If boating, secure any unsecured objects on deck; they may shift on deck quickly in wave, current, or engine acceleration conditions. • Maintain a safe distance from closing mechanisms and moving parts on sampling gear. • Avoid placing hands or self between boat and dock/piles.	
Working outdoors	Heat stress	• Adjust work schedules, as necessary, to avoid the hottest part of the day. • Take rest breaks as warranted. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.

Sediment Sampling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Working outdoors (continued)	Cold stress	• Provide shelter (enclosed, heated environment) to protect personnel during rest periods. • Educate workers to recognize the symptoms of frostbite and hypothermia. • Use appropriate cold-weather gear, up to and including Mustang-type bib coveralls or jacket/bib combinations. • Consider additional precautions if working near water in cold weather. • Have a dry change of clothing available. • Train workers to recognize the symptoms of cold-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions and PPE. • Monitor outside and water temperature versus worker activity and PPE.
	Rain or snow	• Wear appropriate PPE (rain gear). • Be aware of slip hazards, puddles, and electrical hazards when working in wet conditions. • If extremely cold conditions are forecast, consider additional precautions or postponing work activity.	• Review weather forecast prior to field work. • Inspect PPE daily prior to use. • Routinely inspect work area for deteriorating conditions.
	Sunshine	• Have sunscreen available for ultraviolet protection. • Have abundant water available to prevent dehydration. • Consider wearing wide-brimmed headwear and light-colored, lightweight, sun-blocking clothing.	• Ensure that sunscreen and water are available.
	Lightning	• Do not begin or continue work until lightning subsides for 30 minutes. Disconnect and do not use or touch electronic equipment. • Immediately head for shore if on the water and lightning is observed. If not able to get to shore, disconnect and do not use or touch the major electronic equipment, including the radio, throughout the duration of the storm.	• Obtain weather forecast and updates as needed.
	High winds	• Wear goggles or safety glasses if dust or debris are visible.	• Review weather forecast prior to field work. • Ensure that goggles or safety glasses are available.

Sediment Sampling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Working outdoors (continued)	Biological hazards (flora [e.g., poison ivy and poison oak] and fauna [e.g., ticks, bees, spiders, mosquitoes, and snakes])	• Be aware of likely biological hazards in the work area. • Wear appropriate clothing (i.e., hat, long-sleeve shirt, long pants, leather gloves, boots, and Tyvek coveralls, as appropriate), and apply insect repellant. • Wear hand and arm protection when clearing plants or debris from the work area.	• Ensure that insect repellent is available. • Inspect clothing and skin for insects (e.g., ticks) after working in insect-prone areas.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).
- If boating is involved, and a professional captained vessel is not in use, boat operators must take the appropriate state or provincial boater safety courses.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Job Safety Analysis

General Boating Activities

Project Name: Port of Seattle T-25 South Design Characterization	**Project Number:** 160003-03.01	**JSA Number:** 003	**Issue Date:** 1/11/19
Location: Terminal 25 – Port of Seattle	**Contractor:** Anchor QEA, LLC	**Analysis by:** Casey Janisch	**Analysis Date:** 1/06/19
Work Operation: General boating activities	**Superintendent/Competent Person:** Field Team	**Revised by:** N/A	**Revised Date:** N/A
Required Personal Protective Equipment (PPE): • U.S. Coast Guard (USCG)-approved personal flotation device (PFD; see cold stress section for cold-weather PFD information)		**Reviewed by:** Nik Bacher	**Reviewed Date:** 1/10/19
		Approved by: Nik Bacher	**Approved Date:** 1/10/19

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Walking on deck	Pinch points	• Secure any unsecured objects on deck; they may shift quickly in wave, current, or engine acceleration conditions. • Maintain a safe distance from closing mechanisms and moving parts, such as on sampling gear. • Avoid placing your hands or yourself between the boat and the dock or piles.	
	Slips, trips, and falls	• Avoid walking while writing or texting—maintain a heads-up posture. • Be aware of potentially slippery surfaces, including boat decks, riprap, muddy or algae-covered rocks, shoreline plants or seaweed, thick mud, and tripping hazards. Use handrails where available. Wear footwear that has sufficient traction. • Maintain good housekeeping practices. Clean up all spills immediately. • Be aware of weather effects on the work area, including wet and/or frozen ground. • Jumping, running, and horseplay are prohibited. • Be cautious when entering or exiting the vessel, and load/unload items onto/off of the pier or shore once boarded. • Keep all areas clean and free of debris to prevent any trips and falls. • Notify the field team members of any unsafe conditions. • Keep rope lines neatly coiled and stowed. Avoid stepping on or over lines.	• Routinely inspect work area for unsafe conditions.
	Exceeding boat capacity	• Keep the number of passengers and equipment as posted on boat placards within limits at all times. If conditions warrant, reduce capacity to maintain boat stability.	• Ensure that field team is aware of limits and adheres accordingly.

General Boating Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Walking on deck (continued)	Noise exposure	• Wear hearing protection in high noise environments or when working around heavy machinery or equipment (action level of 85 decibels averaged over an 8-hour day).	• Ensure that hearing protection is available.
Working outdoors	Heat stress	• Adjust work schedules, as necessary, to avoid the hottest part of the day. • Take rest breaks as warranted. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.
	Cold stress	• Provide shelter (enclosed, heated environment) to protect personnel during rest periods. • Educate workers to recognize the symptoms of frostbite and hypothermia. • If the combined air and water temperature is below 90 degrees Fahrenheit (°F), wear a USCG-approved float coat, Mustang-type bib coveralls, or one-piece survival suit. • Have a dry change of clothing available. • Train workers to recognize the symptoms of cold-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions and PPE. • Monitor outside and water temperature versus worker activity and PPE.
	Rain or snow	• Wear appropriate PPE (rain gear). • Be aware of slip hazards, puddles, and electrical hazards when working in wet conditions. • If extremely cold conditions are forecast, consider additional precautions or postponing work activity.	• Review weather forecast prior to field work. • Inspect PPE daily prior to use. • Routinely inspect work area for deteriorating conditions.
	Sunshine	• Have sunscreen available for ultraviolet protection. • Have abundant water available to prevent dehydration. • Consider wearing wide-brimmed headwear and light-colored, lightweight, sun-blocking clothing.	• Ensure that sunscreen and water are onboard.
	Fog	• Wait for fog to lift for adequate visibility.	• Review weather forecast prior to field work.

General Boating Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Working outdoors (continued)	Lightning	• Do not begin or continue work until lightning subsides for at least 30 minutes. Disconnect and do not use or touch electronic equipment. • Immediately head for shore if on the water and lightning is observed. • If not able to get to shore, disconnect and do not use or touch the major electronic equipment, including the radio, throughout the duration of the storm.	• Obtain weather forecast and updates as needed.
	High river flows or high waves	• Be aware of waves and forecasts and recent rainfall in your watershed.	• Have forecast available.
	High winds	• Wear goggles or safety glasses if dust or debris are visible. • Stow or secure loads or equipment that could be moved by wind, particularly when underway.	• Review weather forecast prior to field work. • Ensure that goggles or safety glasses are onboard.
	Biological hazards (e.g., mosquitoes, deer flies, and horse flies)	• Wear appropriate clothing (i.e., hat, long-sleeve shirt, long pants, leather gloves, boots, and Tyvek coveralls, as appropriate), and apply insect repellent.	• Ensure that insect repellent is onboard.
Vessel emergencies	Person overboard	If you witness someone fall overboard: • Yell, "Person overboard!" • Throw a flotation device immediately. • If the engine is running, take it out of gear and swing the stern clear to keep from hitting the person. • Call 911 or USCG as appropriate. • Assign a spotter to keep the person in sight at all times. • Contact nearby vessels for assistance. • Recover the person from the water. If you fall overboard: • Hold your mouth and nose closed and protect your head. • When you reach the surface, look for movement, listen for sounds, and call for help. Use the whistle attached to the PFD and activate the beacon light. • It is only sensible to swim if there is reason to believe you have a chance of reaching your destination. Too much movement in cold water causes hypothermia.	• Ensure that flotation devices are available. • Ensure that team wears PFDs. • Inspect PFDs for integrity, particularly the cartridge charge on inflatable PFDs.

General Boating Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Vessel emergencies (continued)	Fire, abandon ship	• Be prepared to abandon ship in case of major fire (too large to control with a fire extinguisher), or other emergency. • Only the boat captain can order abandon ship. • Communicate intent to abandon ship to all personnel onboard. • Notify USCG and nearby vessels of intent to abandon ship. • Call 911. • Notify the Project Manager and Field Lead, if time permits. • Be aware of the propeller position before abandoning ship. • Identify a rally point for all personnel. • Know the dangers of hypothermia. • Use the buddy system to support injured personnel.	• Ensure that fire extinguisher is available, current, and in working order. • Review abandon ship procedures with field team prior to work.
Navigation	Boat traffic	• Maintain a safe operating distance from shoreline and other vessels.	• Be aware of on-water surroundings.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).
- If professional captained vessel is not in use, boat operators must take appropriate state or provincial boater safety courses.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Job Safety Analysis

Decontamination Activities

Project Name: Port of Seattle T-25 South Design Characterization	**Project Number:** 160003-03.01	**JSA Number:** 004	**Issue Date:** 1/11/19
Location: Terminal 25 – Port of Seattle	**Contractor:** Anchor QEA, LLC	**Analysis by:** Casey Janisch	**Analysis Date:** 1/06/19
Work Operation: Decontamination activities	**Superintendent/Competent Person:** Field Team	**Revised by:** N/A	**Revised Date:** N/A
Required Personal Protective Equipment (PPE): • High-visibility safety vest • Hard hat where overhead hazards and/or heavy equipment are present • U.S. Coast Guard-approved personal flotation device (PFD), if boating (see cold stress section for cold-weather PFD information)		**Reviewed by:** Nik Bacher	**Reviewed Date:** 1/10/19
		Approved by: Nik Bacher	**Approved Date:** 1/10/19

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
If boating		• Follow the Job Safety Analysis (JSA) for boating activities.	
Decontamination area set up	Vehicle, heavy equipment traffic, or boat traffic in work area	• Wear high-visibility safety vest and hard hat PPE. • Be alert when working around heavy equipment and/or other boats, especially if wearing hearing protection.	• Ensure that safety vests are available for staff and visitors.
	Muscle strain or injuries from improper lifting	• Use proper lifting techniques or ask for assistance with heavy objects. • If boating, avoid carrying objects directly onto or off of the boat; rather, load/unload objects while on the boat to/from the pier/shore.	• Evaluate weight and center of gravity of heavier items prior to lifting or moving.
	Biological hazards (flora [e.g., poison ivy, and poison oak] and fauna [e.g., ticks, bees, spiders, mosquitoes, and snakes])	• Be aware of likely biological hazards in the work area. • Wear appropriate clothing (i.e., hat, long-sleeve shirt, long pants, leather gloves, boots, and Tyvek coveralls, as appropriate), and apply insect repellent. • Wear hand and arm protection when clearing plants or debris from the work area.	• Ensure that insect repellent is available. • Inspect clothing and skin for insects (e.g., ticks) after working in insect-prone areas.

Job Safety Analysis

ANCHOR QEA

Decontamination Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Decontamination activities	Injury from hand and power tool operation (e.g., spatula or drill)	• Be aware of sharp edges on hand tools (e.g., spatulas, knives, drill bits, and saw blades). • Be aware of electrical connections and water hazards when working with electric- or battery-operated tools. • Ensure that all tools are working properly; repair or replace defective tools. Repair when unplugged and off. • Keep guards on power tools when not in use.	• Inspect tools to ensure that they are in good working order. • Inspect electrical connections (if applicable). • Inspect tools periodically to ensure dry and clean operation.
	Noise exposure	• Wear hearing protection in high noise environments or when working around heavy machinery or equipment (action level of 85 decibels averaged over an 8-hour day).	• Ensure that hearing protection is available.
	Slips, trips, and falls	• Avoid walking while writing or texting—maintain a heads-up posture. • Be aware of potentially slippery surfaces and tripping hazards. Use handrails where available. Wear footwear that has sufficient traction. • Maintain good housekeeping practices. Clean up all spills immediately. • Be aware of weather effects on the work area, including wet and/or frozen ground. • Jumping, running, and horseplay are prohibited. • Keep all areas clean and free of debris to prevent any trips and falls. • Notify the field team members of any unsafe conditions.	• Routinely inspect work area for unsafe conditions.
	Ingestion of contaminants or decontamination fluids, or skin or eye contact with contaminants or decontamination fluids	• Wear appropriate PPE to prevent/reduce exposure. • Contact 911, as necessary; perform CPR if breathing stops. • Move exposed person away from source of contamination, and rinse mouth. If exposure to skin occurs, promptly wash contaminated skin using soap or mild detergent and water. Rinse eyes with large amounts of water. • Follow decontamination procedures as outlined in the Health and Safety Plan (HASP).	• Ensure that decontamination procedures are on hand and are reviewed. • Ensure that PPE and rinsing water are available.
Working outdoors	Heat stress	• Adjust work schedules, as necessary, to avoid the hottest part of the day. • Take rest breaks as warranted. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.

Decontamination Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Working outdoors (continued)	Cold stress	• Provide shelter (enclosed, heated environment) to protect personnel during rest periods. • Educate workers to recognize the symptoms of frostbite and hypothermia. • Use appropriate cold-weather gear, up to and including Mustang-type bib coveralls or jacket/bib combinations. • Consider additional precautions if working near water in cold weather. • Have a dry change of clothing available. • Train workers to recognize the symptoms of cold-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions and PPE. • Monitor outside and water temperature versus worker activity and PPE.
	Rain or snow	• Wear appropriate PPE (rain gear). • Be aware of slip hazards, puddles, and electrical hazards when working in wet conditions. • If extremely cold conditions are forecast, consider additional precautions or postponing work activity.	• Review weather forecast prior to field work. • Inspect PPE daily prior to use. • Routinely inspect work area for deteriorating conditions.
	Sunshine	• Have sunscreen available for ultraviolet protection. • Have abundant water available to prevent dehydration. • Consider wearing wide-brimmed headwear and light-colored, lightweight, sun-blocking clothing.	• Ensure that sunscreen and water are available.
	Lightning	• Do not begin or continue work until lightning subsides for at least 30 minutes. Disconnect and do not use or touch electronic equipment.	• Obtain weather forecast and updates as needed.
	High winds	• Wear goggles or safety glasses if dust or debris are visible.	• Review weather forecast prior to field work. • Ensure that goggles or safety glasses are available.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).

Decontamination Activities

- If boating is involved, and a professional captained vessel is not in use, boat operators must take the appropriate state or provincial boater safety courses.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Job Safety Analysis

Sample and Laboratory Glassware Handling

Project Name: Port of Seattle T-25 South Design Characterization	**Project Number:** 160003-03.01	**JSA Number:** 009	**Issue Date:** 1/11/19
Location: Terminal 25 – Port of Seattle	**Contractor:** Anchor QEA, LLC	**Analysis by:** Casey Janisch	**Analysis Date:** 1/06/19
Work Operation: Sample and laboratory glassware handling	**Superintendent/Competent Person:** Field Team	**Revised by:** N/A	**Revised Date:** N/A
Required Personal Protective Equipment (PPE): • Modified Level D—Long pants, long sleeves, and/or Tyvek coveralls if handling potentially contaminated media, and steel-toed footwear conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05 • Depending on activity, the following PPE may also be required: safety glasses/splash goggles, hard hat, nitrile outer gloves and latex inner gloves, and, if boating, U.S. Coast Guard-approved personal flotation device (PFD)		**Reviewed by:** Nik Bacher	**Reviewed Date:** 1/10/19
		Approved by: Nik Bacher	**Approved Date:** 1/10/19

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Transporting and using glassware	Breakage of containers during field activities	• Use appropriately sized tubs or bottle carriers with dividers to prevent bottle-to-bottle contact during transport. • Consider using coated glassware, if practicable. • Carry oversize bottles in tubs or bottle carriers using both hands during transfer to the sampling vessel and whenever the vessel is underway.	• Ensure dividers are sufficient and will remain in place during transport.
	Faulty glassware	• Replace any glassware that is chipped, nicked, or cracked.	• Inspect glassware before use.
	Impact with equipment and other objects	• Use care when loading and unloading sampling equipment. • Minimize the handling of individual containers to the extent possible.	
Filling sample containers	Over-tightening of bottle lids causing breakage	• Avoid use of excessive force to tighten bottle caps (i.e., finger tight). • Secure lids with clear tape to prevent opening during transport.	
	Breakage during sample collection	• Place containers in plastic tubs between aliquots to limit contact with hard surfaces. • Place containers on a stable and non-slip surface during collection. • Use the buddy system as needed to hold bottles during filling.	

Job Safety Analysis

ANCHOR QEA

Sample and Laboratory Glassware Handling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Filling sample containers (continued)	Contact with sample preservatives (generally HCL or H_2SO_4 to lower pH to less than 2)	• Wear nitrile gloves and protective eyewear to prevent skin and eye contact if a container is damaged. • Do not open preserved bottles until necessary.	
Packing samples for shipment	Breakage during packing and shipment	• Use bottle wraps, foam sleeves, or bubble wrap to prevent bottle contact in the cooler. • Pack coolers snugly, but do not over pack.	• Ensure glass bottles do not touch to minimize potential breakage during transport.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including, but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

PLAYING IT SAFE

Job Safety Analysis

Investigation-derived Waste Management

Project Name: Port of Seattle T-25 South Design Characterization	**Project Number:** 160003-03.01	**JSA Number:** 010	**Issue Date:** 1/11/19
Location: Terminal 25 – Port of Seattle	**Contractor:** Anchor QEA, LLC	**Analysis by:** Casey Janisch	**Analysis Date:** 1/06/19
Work Operation: Investigation-derived waste management	**Superintendent/Competent Person:** Field Team	**Revised by:** N/A	**Revised Date:** N/A
Required Personal Protective Equipment (PPE): • Modified Level D—Long pants, long sleeves, and/or Tyvek coveralls if handling potentially contaminated media, and steel-toed footwear conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05 • Depending on activity, the following PPE may also be required: safety glasses/splash goggles, hard hat, nitrile outer gloves and latex inner gloves, and, if boating, U.S. Coast Guard-approved personal flotation device (PFD)		**Reviewed by:** Nik Bacher	**Reviewed Date:** 1/10/19
		Approved by: Nik Bacher	**Approved Date:** 1/10/19

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Containerizing investigation-derived waste (IDW) at the source	Lifting	• Use care when lifting to redistribute IDW from one container (e.g., drums and buckets) to another at the source. • Seek assistance if loads are too heavy, or if you are experiencing fatigue. • Fill containers only to the degree that will be manageable in the future (e.g., half full) and to limit weight.	• Inspect containers for competency (i.e., no cracks, and handles in good repair).
	Pinch points	• Wear hand protection when closing containers. • Use the buddy system when affixing drum rings.	• Inspect drums for rust or sharp edges prior to opening or closing.
Relocating or staging IDW containers	Lifting	• Use task-specific tools whenever possible to move full containers (i.e., hoists, drum caddies or dollies, and vehicles). • When task-specific tools are not available, use the buddy system to move containers that are reasonable to lift. • Never roll drums or containers holding IDW. • Stage containers in areas protected from heavy traffic and weather, if possible.	• Ensure tools are in good repair. • Assess IDW container weight prior to moving.

Investigation-derived Waste Management

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Relocating or staging IDW containers (continued)	Pinch points or crushing	• Use tools to achieve the final arrangement when staging containers—do not place hands on the edges of containers while moving them into place. • Stand well clear of containers being moved in case they become dislodged from their handling tool during transport. • Do not stack IDW containers, as this poses a risk for container toppling and damage. • Place containers on a wooden pallet for easy transfer using a pallet jack, if possible.	• Inspect drums for evidence of cracks or rust.
IDW management – general	Splash	• Wear the required PPE at all times. • Use care to minimize splashing or smearing of IDW during handling and containerization.	• Inspect PPE upon donning and periodically during tasks.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Job Safety Analysis

Sonic Drilling

Project Name: Port of Seattle T-25 South Design Characterization	**Project Number:** 160003-03.01	**JSA Number:** 011	**Issue Date:** 1/11/19
Location: Terminal 25 – Port of Seattle	**Contractor:** Holocene	**Analysis by:** Bernadette Wright	**Analysis Date:** 1/8/19
Work Operation: Soil sampling	**Superintendent/Competent Person:** Field Team	**Revised by:** N/A	**Revised Date:** N/A
Required Personal Protective Equipment (PPE): • Level D/Modified Level D • Long pants, long sleeves, and/or Tyvek coveralls if handling potentially contaminated media • Work boots with safety toe conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05 • High-visibility traffic safety vest (High-visibility PFD sufficient) • Safety glasses • Hard hat if overhead hazard present • Hearing protection when there are high noise levels • High-visibility U.S. Coast Guard-approved personal flotation device (PFD) (if working within 10 feet of water) (see cold stress section for cold-weather PFD information) • Disposable chemical-resistant nitrile outer gloves and disposable inner gloves (latex or equivalent "surgical")		**Reviewed by:** Nik Bacher	**Reviewed Date:** 1/10/19
		Approved by: Nik Bacher	**Approved Date:** 1/10/19

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
If boating		• Follow the Job Safety Analysis (JSA) for boating activities.	
Sonic drilling	Inhalation of contaminated dust, inhalation of volatile contaminants	• Document change of conditions that would require air monitoring per the HASP • Wear appropriate PPE • Contact 911 as necessary • If worker exposed to organic vapors, move the exposed person to fresh air, rinse mouth. Have a trained person perform CPR if breathing stops • Keep the affected person warm and at rest.	

Job Safety Analysis

Sonic Drilling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Sonic drilling (continued)	Noise exposure	• Wear hearing protection in high noise or sonic vibration environments or when working around heavy machinery or equipment (action level of 85 decibels averaged over an 8-hour day).	• Ensure that hearing protection is available.
	Slips, trips, and falls	• Avoid walking while writing or texting—maintain a heads-up posture. • Be aware of potentially slippery surfaces, including boat decks, riprap, muddy or algae-covered rocks, shoreline plants/seaweed, thick mud, and tripping hazards. Use handrails where available. Wear footwear that has sufficient traction. • Maintain good housekeeping practices. Clean up all spills immediately. • Be aware of weather effects on the work area, including wet and/or frozen ground. • Jumping, running, and horseplay are prohibited. • Be cautious when entering or exiting the vessel, and load/unload items onto/off of the pier or shore once boarded. • Keep all areas clean and free of debris to prevent any trips and falls. • Notify the field team members of any unsafe conditions.	• Routinely inspect work area for unsafe conditions.
	Ingestion of contaminants, skin/eye contact with contaminants	• Wear appropriate PPE to prevent/reduce exposure. • Contact 911, as necessary; perform CPR if breathing stops. • Move exposed person away from source of contamination, and rinse mouth. If exposure to skin occurs, promptly wash contaminated skin using soap or mild detergent and water. Rinse eyes with large amounts of water. • Follow decontamination procedures as outlined in the Health and Safety Plan (HASP).	• Ensure that decontamination procedures are on hand and are reviewed. • Ensure that PPE and rinsing water are available.
	Muscle strain or injuries from improper lifting	• Use proper lifting techniques or ask for assistance with heavy objects. • If boating, avoid carrying objects directly onto or off the boat; rather, load/unload objects while on the boat to/from the pier/shore.	• Evaluate weight and center of gravity of heavier items prior to lifting or moving.
	Pinch points	• If boating, secure any unsecured objects on deck; they may shift on deck quickly in wave, current, or engine acceleration conditions. • Maintain a safe distance from closing mechanisms and moving parts on sampling gear. • Avoid placing hands or self between boat and dock/piles. • Maintain awareness of procedures underway and be attentive of sampling operators • Maintain safe distance from spud and winch when in operation	
	Overhead Hazards	• Inspect work area for overhead powerlines or cables • Maintain awareness of the sonic rig mast and overhead components. • Maintain awareness of barge spuds	• Inspect field area and winch cable

Sonic Drilling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Working outdoors	Heat stress	• Adjust work schedules, as necessary, to avoid the hottest part of the day. • Take rest breaks as warranted. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.
	Cold stress	• Provide shelter (enclosed, heated environment) to protect personnel during rest periods. • Educate workers to recognize the symptoms of frostbite and hypothermia. • Use appropriate cold-weather gear, up to and including Mustang-type bib coveralls or jacket/bib combinations. • Consider additional precautions if working near water in cold weather. • Have a dry change of clothing available. • Train workers to recognize the symptoms of cold-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions and PPE. • Monitor outside and water temperature versus worker activity and PPE.
	Rain/Snow	• Wear appropriate PPE (rain gear). • Be aware of slip hazards, puddles, and electrical hazards when working in wet conditions. • If extremely cold conditions are forecast, consider additional precautions or postponing work activity.	• Review weather forecast prior to field work. • Inspect PPE daily prior to use. • Routinely inspect work area for deteriorating conditions.
	Sunshine	• Have sunscreen available for ultraviolet protection. • Have abundant water available to prevent dehydration. • Consider wearing wide-brimmed headwear and light-colored, lightweight, sun-blocking clothing.	• Ensure that sunscreen and water are available.
	Lightning	• Do not begin or continue work until lightning subsides for 30 minutes. Disconnect and do not use or touch electronic equipment. • Immediately head for shore if on the water and lightning is observed. If not able to get to shore, disconnect and do not use or touch the major electronic equipment, including the radio, throughout the duration of the storm.	• Obtain weather forecast and updates as needed.

Sonic Drilling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Working outdoors (continued)	High winds	• Wear goggles or safety glasses if dust or debris are visible.	• Review weather forecast prior to field work. • Ensure that goggles or safety glasses are available.
	Biological hazards (e.g., bees, wasps, spiders, and mosquitoes)	• Be aware of likely biological hazards in the work area. • Wear appropriate clothing (i.e., hat, long-sleeve shirt, long pants, leather gloves, boots, and Tyvek coveralls, as appropriate), and apply insect repellant. • Wear hand and arm protection when clearing plants or debris from the work area.	• Ensure that insect repellent is available. • Inspect clothing and skin for insects after working in insect-prone areas.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).
- If boating is involved, and a professional captained vessel is not in use, boat operators must take the appropriate state or provincial boater safety courses.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Appendix C
Safety Data Sheets (SDS)

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Printing date: 31.12.2013 **Revision:** 31.12.2013

1 Identification of the substance/mixture and of the company/undertaking

· **1.1 Product identifier**

· **Trade name: ALCONOX**

· **1.2 Relevant identified uses of the substance or mixture and uses advised against**
No further relevant information available.

· **Application of the substance / the mixture:** Cleaning material/ Detergent

· **1.3 Details of the supplier of the Safety Data Sheet**

· **Manufacturer/Supplier:**
Alconox, Inc.
30 Glenn St., Suite 309
White Plains, NY 10603
Phone: 914-948-4040

· **Further information obtainable from:** Product Safety Department

· **1.4 Emergency telephone number:**
ChemTel Inc.
(800)255-3924, +1 (813)248-0585

2 Hazards identification

· **2.1 Classification of the substance or mixture**

· **Classification according to Regulation (EC) No 1272/2008**

GHS05 corrosion

Eye Dam. 1; H318: Causes serious eye damage.

GHS07

Skin Irrit. 2; H315: Causes skin irritation.

· **Classification according to Directive 67/548/EEC or Directive 1999/45/EC**

Xi; Irritant

R38-41: Irritating to skin. Risk of serious damage to eyes.

· **Information concerning particular hazards for human and environment:**
The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

· **Classification system:**
The classification is according to the latest editions of the EU-lists, and extended by company and literature data.
The classification is in accordance with the latest editions of international substances lists, and is supplemented by information from technical literature and by information provided by the company.

· **2.2 Label elements**

· **Labelling according to Regulation (EC) No 1272/2008**
The product is classified and labelled according to the CLP regulation.

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Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

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Trade name: ALCONOX

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· **Hazard pictograms**

GHS05

· **Signal word:** Danger

· **Hazard-determining components of labelling:**
sodium dodecylbenzene sulfonate

· **Hazard statements**
H315: Causes skin irritation.
H318: Causes serious eye damage.

· **Precautionary statements**
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P264: Wash thoroughly after handling.
P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310: Immediately call a POISON CENTER or doctor/physician.
P321: Specific treatment (see on this label).
P362: Take off contaminated clothing and wash before reuse.
P332+P313: If skin irritation occurs: Get medical advice/attention.
P302+P352: IF ON SKIN: Wash with plenty of soap and water.

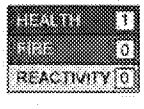
· **Hazard description:**

· **WHMIS-symbols:**
D2B - Toxic material causing other toxic effects

· **NFPA ratings (scale 0 - 4)**

Health = 1
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**



Health = 1
Fire = 0
Reactivity = 0

· **HMIS Long Term Health Hazard Substances**
None of the ingredients is listed.

· **2.3 Other hazards**

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:** Not applicable.

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Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

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3 Composition/information on ingredients

· **3.2 Mixtures**
· **Description:** Mixture of substances listed below with nonhazardous additions.

· **Dangerous components:**		
CAS: 68081-81-2	sodium dodecylbenzene sulfonate Xn R22; Xi R36 Acute Tox. 4, H302; Eye Irrit. 2, H319	10-25%
CAS: 497-19-8 EINECS: 207-838-8 Index number: 011-005-00-2	Sodium Carbonate Xi R36 Eye Irrit. 2, H319	2,5-10%
CAS: 7722-88-5 EINECS: 231-767-1	tetrasodium pyrophosphate substance with a Community workplace exposure limit	2,5-10%
CAS: 151-21-3 EINECS: 205-788-1	sodium dodecyl sulphate Xn R21/22; Xi R36/38 Acute Tox. 4, H302; Acute Tox. 4, H312; Skin Irrit. 2, H315; Eye Irrit. 2, H319	2,5-10%

· **Additional information:** For the wording of the listed risk phrases refer to section 16.

4 First aid measures

· **4.1 Description of first aid measures**
· **After inhalation:** Supply fresh air; consult doctor in case of complaints.
· **After skin contact:**
Immediately wash with water and soap and rinse thoroughly.
If skin irritation continues, consult a doctor.
· **After eye contact:**
Remove contact lenses if worn.
Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
· **After swallowing:**
Rinse out mouth and then drink plenty of water.
Do not induce vomiting; call for medical help immediately.
· **4.2 Most important symptoms and effects, both acute and delayed**
No further relevant information available.
· **4.3 Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Firefighting measures

· **5.1 Extinguishing media**
· **Suitable extinguishing agents:**
CO2, powder or water spray. Fight larger fires with water spray or alcohol resistant foam.

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Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

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· **5.2 Special hazards arising from the substance or mixture:** No further relevant information available.
· **5.3 Advice for firefighters**
· **Protective equipment:**
Wear self-contained respiratory protective device.
Wear fully protective suit.
· **Additional information:** No further relevant information available.

6 Accidental release measures

· **6.1 Personal precautions, protective equipment and emergency procedures**
Product forms slippery surface when combined with water.
· **6.2 Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **6.3 Methods and material for containment and cleaning up:**
Pick up mechanically.
Clean the affected area carefully; suitable cleaners are:
Warm water
· **6.4 Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

7 Handling and storage

· **7.1 Precautions for safe handling**
Prevent formation of dust.
Keep receptacles tightly sealed.
· **Information about fire - and explosion protection:** No special measures required.

· **7.2 Conditions for safe storage, including any incompatibilities**
· **Storage:**
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Protect from humidity and water.
· **7.3 Specific end use(s):** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical facilities:** No further data; see item 7.

· **8.1 Control parameters**

· **Ingredients with limit values that require monitoring at the workplace:**	
7722-88-5 tetrasodium pyrophosphate	
REL (USA)	5 mg/m³
TLV (USA)	TLV withdrawn
EV (Canada)	5 mg/m³

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Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Printing date: 31.12.2013 **Revision:** 31.12.2013

Trade name: ALCONOX

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· **Additional information:** The lists valid during the making were used as basis.

· **8.2 Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the skin.
Avoid contact with the eyes and skin.
· **Respiratory protection:**
Not required under normal conditions of use.
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use self-contained respiratory protective device.
· **Protection of hands:**


Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation.
· **Material of gloves**
Butyl rubber, BR
Nitrile rubber, NBR
Natural rubber, NR
Neoprene gloves
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material cannot be calculated in advance and has therefore to be checked prior to the application.
· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.
· **Eye protection:**


Safety glasses

· **Body protection:** Protective work clothing

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Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Printing date: 31.12.2013 **Revision:** 31.12.2013

Trade name: ALCONOX

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9 Physical and chemical properties

· **9.1 Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Powder
Colour:	White
· **Odour:**	Odourless
· **Odour threshold:**	Not determined.
· **pH-value (10 g/l) at 20 °C:**	9,5 (- NA for Powder form)
· **Change in condition**	
Melting point/Melting range:	Not Determined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Not determined.
· **Ignition temperature:**	
Decomposition temperature:	Not determined.
· **Self-igniting:**	Product is not self-igniting.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapour pressure:**	Not applicable.
· **Density at 20 °C:**	1,1 g/cm³
· **Relative density**	Not determined.
· **Vapour density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with water:**	Soluble.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
· **Solvent content:**	
Organic solvents:	0,0 %
Solids content:	100 %
· **9.2 Other information**	No further relevant information available.

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Trade name: ALCONOX

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10 Stability and reactivity

· **10.1 Reactivity**
· **10.2 Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **10.3 Possibility of hazardous reactions**
Reacts with acids.
Reacts with strong alkali.
Reacts with strong oxidizing agents.
· **10.4 Conditions to avoid:** No further relevant information available.
· **10.5 Incompatible materials:** No further relevant information available.
· **10.6 Hazardous decomposition products:**
Carbon monoxide and carbon dioxide
Phosphorus compounds
Sulphur oxides (SOx)

11 Toxicological information

· **11.1 Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **On the skin:** Irritant to skin and mucous membranes.
· **On the eye:** Strong irritant with the danger of severe eye injury.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**
The product shows the following dangers according to the calculation method of the General EU Classification Guidelines for Preparations as issued in the latest version:
Irritant
Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation of esophagus and stomach.

12 Ecological information

· **12.1 Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **12.2 Persistence and degradability:** No further relevant information available.
· **12.3 Bioaccumulative potential:** Not worth-mentioning accumulating in organisms
· **12.4 Mobility in soil:** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 2 (German Regulation) (Self-assessment): hazardous for water.
Do not allow product to reach ground water, water course or sewage system.
Danger to drinking water if even small quantities leak into the ground.
· **12.5 Results of PBT and vPvB assessment**
· **PBT:** Not applicable.

(Contd. on page 8)

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Printing date: 31.12.2013 **Revision:** 31.12.2013

Trade name: ALCONOX

(Contd. of page 7)

· **vPvB:** Not applicable.
· **12.6 Other adverse effects:** No further relevant information available.

13 Disposal considerations

· **13.1 Waste treatment methods**
· **Recommendation**
Smaller quantities can be disposed of with household waste.
Small amounts may be diluted with plenty of water and washed away. Dispose of bigger amounts in accordance with Local Authority requirements.
The surfactant used in this product complies with the biodegradability criteria as laid down in Regulation (EC) No. 648/2004 on detergents. Data to support this assertion are held at the disposal of the competent authorities of the Member States and will be made available to them, at their direct request or at the request of a detergent manufacturer.

· **Uncleaned packaging:**
· **Recommendation:** Disposal must be made according to official regulations.
· **Recommended cleansing agents:** Water, if necessary together with cleansing agents.

14 Transport information

· **14.1 UN-Number** · **DOT, ADR, IMDG, IATA, ICAO**	Not Regulated
· **14.2 UN proper shipping name** · **DOT, ADR, IMDG, IATA, ICAO**	Not Regulated
· **14.3 Transport hazard class(es)** · **DOT, ADR, IMDG, IATA, ICAO** · **Class**	Not Regulated
· **14.4 Packing group** · **DOT, ADR, IMDG, IATA, ICAO**	Not Regulated
· **14.5 Environmental hazards:** · **Marine pollutant:**	No
· **14.6 Special precautions for user**	Not applicable.
· **14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	Not Regulated

(Contd. on page 9)

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Printing date: 31.12.2013 **Revision:** 31.12.2013

Trade name: ALCONOX

(Contd. of page 8)

15 Regulatory information

· **15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture**
· **United States (USA)**
· **SARA**

· **Section 355 (extremely hazardous substances):**
None of the ingredients is listed.
· **Section 313 (Specific toxic chemical listings):**
None of the ingredients is listed.
· **TSCA (Toxic Substances Control Act):**
All ingredients are listed.

· **Proposition 65 (California):**

· **Chemicals known to cause cancer:**
None of the ingredients is listed.
· **Chemicals known to cause reproductive toxicity for females:**
None of the ingredients is listed.
· **Chemicals known to cause reproductive toxicity for males:**
None of the ingredients is listed.
· **Chemicals known to cause developmental toxicity:**
None of the ingredients is listed.

· **Carcinogenic Categories**

· **EPA (Environmental Protection Agency)**
None of the ingredients is listed.
· **IARC (International Agency for Research on Cancer)**
None of the ingredients is listed.
· **TLV (Threshold Limit Value established by ACGIH)**
None of the ingredients is listed.
· **NIOSH-Ca (National Institute for Occupational Safety and Health)**
None of the ingredients is listed.
· **OSHA-Ca (Occupational Safety & Health Administration)**
None of the ingredients is listed.

(Contd. on page 10)

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Printing date: 31.12.2013 **Revision:** 31.12.2013

Trade name: ALCONOX

(Contd. of page 9)

· **Canada**

· **Canadian Domestic Substances List (DSL)**	
All ingredients are listed.	
· **Canadian Ingredient Disclosure list (limit 0.1%)**	
None of the ingredients is listed.	
· **Canadian Ingredient Disclosure list (limit 1%)**	
497-19-8	Sodium Carbonate
7722-88-5	tetrasodium pyrophosphate
151-21-3	sodium dodecyl sulphate

· **15.2 Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Relevant phrases**
H302: Harmful if swallowed.
H312: Harmful in contact with skin.
H315: Causes skin irritation.
H319: Causes serious eye irritation.

R21/22: Harmful in contact with skin and if swallowed.
R22: Harmful if swallowed.
R36: Irritating to eyes.
R36/38: Irritating to eyes and skin.

· **Abbreviations and acronyms:**
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road) IMDG: International Maritime Code for Dangerous Goods DOT: US Department of Transportation
IATA: International Air Transport Association
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
ACGIH: American Conference of Governmental Industrial Hygienists
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
WHMIS: Workplace Hazardous Materials Information System (Canada)

Appendix D
Certifications

Certificate of Completion

This certifies that

Joyell Dunay

has successfully completed

8 Hour HAZWOPER Refresher Training

Refresher certification does NOT necessarily indicate initial 24 or 40 Hour HAZWOPER certification

In Accordance w/Federal OSHA Regulation 29 CFR 1910.120(e) & (p)

And all State OSHA/EPA Regulations as well including 29 CFR 1926.65 for Construction.

This course (Version 2) is approved for 8 Contact Hours (0.8 CEUs) of continuing education per the California Department of Public Health for Registered Environmental Health Specialist (REHS) (Accreditation # 044).

Julius P. Griggs
Julius P. Griggs
Instructor #892

190106536303
Certificate Number

1/6/2019
Issue Date

SAFETY UNLIMITED, Inc.
OSHA Compliant Safety Training Since 1993

2139 Tapo St., Suite 228 Simi Valley,CA 93063
(888) 309-SAFE (7233) or 805 306-8027
https://www.safetyunlimited.com

Scan this code or visit www.safetyunlimited.com/v to verify certificate.

Proof of initial certification and subsequent refresher training is NOT required to take refresher training

Certificate of Completion

Joy Dunay
has completed requirements for

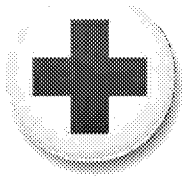
Adult First Aid/CPR/AED

conducted by
American Red Cross

Date completed: 05/23/2017
Validity Period: 2 Years

Certificate ID: GUNT4M

Scan code or visit:
redcross.org/confirm



American Red Cross

Casey Janisch

has successfully completed requirements for

Adult First Aid/CPR/AED: valid 2 Years

Date Completed: 06/06/2018

conducted by: American Red Cross

Instructor: Nicholas Jonathan Flesch

ID: GW974J

Scan code or visit:

redcross.org/confirm

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

Casey Janisch

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

March 29, 2018
Issue Date

SMITH SYSTEM®

Certificate of Completion

Anchor QEA, LLC
720 Olive Way, #1900, Seattle, WA 98101

Casey Janisch — March 29, 2018

Student — Date

This certifies that this participant has successfully completed the Smith System® Driving Distracted Course

Smith System®
Driver Improvement Institute, Inc.
Arlington, Texas
800-777-7648

Certificate of Completion

Evan Malczyk
has completed requirements for

Adult First Aid/CPR/AED

conducted by
American Red Cross

Date completed: 06/06/2018
Validity Period: 2 Years

Certificate ID: GW974M

American Red Cross

Scan code or visit:
redcross.org/confirm

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

Evan Malczyk

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

March 30, 2018
Issue Date

SMITH SYSTEM®

Certificate of Completion

Anchor QEA, LLC
720 Olive Way, #1900, Seattle, WA 98101

Evan Malczyk — March 30, 2018

Student — Date

This certifies that this participant has successfully completed the Smith System® Driving Distracted Course

Smith System®
Driver Improvement Institute, Inc.
Arlington, Texas
800-777-7648

Quality Training: When you want it, where you want it.

Workplace Bloodborne Pathogens

a ProTrainings.com company

This card certifies that the individual has successfully completed the education in OSHA Bloodborne Pathogens Standard 29 CFR 1910.1030

HOLLY SAMAHA

has completed Workplace Bloodborne Pathogens Training

Date Issued: **26 Apr 2018** Renew By: **26 Apr 2019**

Certificate # **152478278898684**

This course includes the following objectives and is consistent with OSHA Bloodborne Pathogens Standard 29 CFR 1910.1030

- -How Bloodborne Pathogens are Spread
- -Hepatitis B Virus
- -Hepatitis C Virus
- -HIV and AIDS
- -Skin Diseases
- -How to Reduce Your Risk
- -Work Practice and Engineering Controls
- -Universal Precautions
- -Regulated Waste
- -Body Fluid Cleanup
- -Personal Protective Equipment
- -Handwashing
- -Exposure Incident and Reporting
- -Course is 1 contact hour

Instructor: ROY W. SHAW #100

888-406-7487 workplace.probloodborne.com support@protrainings.com

Dear Holly,

Above you will find your Bloodborne for the Workplace certification card. You may also access this page at a later time by logging in at www.protrainings.com and clicking the Print Certificate button.

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

Holly Samaha

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

March 30, 2018
Issue Date

SMITH SYSTEM®

Certificate of Completion

Anchor QEA, LLC
720 Olive Way, #1900, Seattle, WA 98101

Holly Samaha — March 30, 2018

Student — Date

This certifies that this participant has successfully completed the Smith System® Driving Distracted Course

Smith System®
Driver Improvement Institute, Inc.
Arlington, Texas
800-777-7648

Certificate of Completion

This certifies that

Holly Samaha

Has Successfully completed

DOT Hazmat Basic General Awareness Training

Includes Safety Awareness and Security Awareness. Does not include: Function Specific, Modal Specific or Driver Training.

In Accordance with 49 CFR 172.704(a)(1) and (a)(4) (Part 172 Subpart H of Title 49)

This Certificate is Valid for Initial or Refresher Training

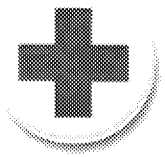
This course is approved for 4 Contact Hours (0.4 CEUs) of continuing education per the California Department of Public Health for Registered Environmental Health Specialist (REHS) (Accreditation # 044)

Julius P. Griggs	1706134484881	6/13/2017
Julius P. Griggs Training Director	Certificate Number	Issue Date

SAFETY UNLIMITED, Inc.
OSHA Compliant Safety Training Since 1993

2139 Tapo St., Suite 228 Simi Valley, CA 93063
888 309-SAFE (7233) or 805 306-8027 866-869-7097 (fax)
www.safetyunlimited.com

Refresher Training Required at Least Every 3 Years
Want to be sure this certificate is valid? Visit safetyunlimited.com/verification



American Red Cross

Holly Samaha

has successfully completed requirements for

Adult First Aid/CPR/AED: valid 2 Years

Date Completed: 05/24/2017

conducted by: American Red Cross

Instructor: Anthony Morales

ID: GUNWPV

Scan code or visit:

redcross.org/confirm

Certificate of Completion

Bernadette Wright
has completed requirements for

Adult First Aid/CPR/AED

conducted by
American Red Cross

Date completed: 06/11/2018
Validity Period: 2 Years

Certificate ID: GWACRQ

American Red Cross

Scan code or visit:
redcross.org/confirm

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

Bernadette Wright

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

March 29, 2018
Issue Date

SMITH SYSTEM®

Certificate of Completion

Anchor QEA, LLC
720 Olive Way, #1900, Seattle, WA 98101

Bernadette Wright — March 29, 2018

Student — Date

This certifies that this participant has successfully completed the Smith System® Driving Distracted Course

Smith System®
Driver Improvement Institute, Inc.
Arlington, Texas
800-777-7648

Appendix B
Field Collection Forms

Daily Log

ANCHOR QEA

PROJECT NAME: _____ **DATE:** _____

SITE ADDRESS: _____ **PERSONNEL:** _____

WEATHER: **WIND FROM:**

N	NE	E	SE	S	SW	W	NW	LIGHT	MEDIUM	HEAVY

SUNNY	CLOUDY	RAIN	?

TEMPERATURE: ° F . ° C

[Circle appropriate units]

TIME	COMMENTS

Signature: _____

ANCHOR QEA

Sediment Core Collection Log

Job: | **Station ID:**

Job No: | **Attempt No.**

Field Staff: | **Date:**

Contractor: | **Logged By:**

Vertical Datum: | **Horizontal Datum: NAD83 WA State Plane North, feet**

Field Collection Coordinates:

Lat/Northing: | Long/Easting:

A. Water Depth

DTM Depth Sounder:

DTM Lead Line:

B. Water Level Measurements

Time:

Height:

Source:

C. Mudline Elevation

Recovery Measurements (prior to cuts)

Core Collection Recovery Details:

Core Accepted: Yes / No

Core Tube Length:

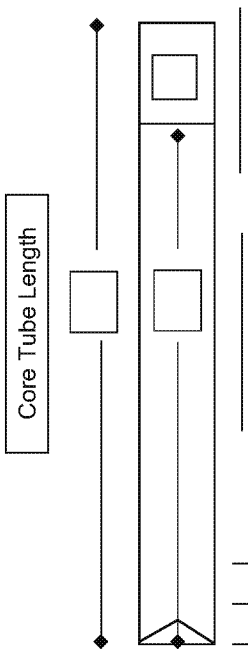
Drive Penetration:

Headspace Measurement:

Recovery Measurement:

Recovery Percentage:

Total Length of Core To Process:



Sections To Process:

A:

B:

C:

D:

Drive Notes:

Core Field Observations and Description:

Sediment type, moisture, color, minor modifier, MAJOR modifier, other constituents, odor, sheen, layering, anoxic layer, debris, plant matter, shells, biota

Notes:

Sediment Core Processing Log

ANCHOR QEA

Job:	Station ID:
Job No.	Date/Time:
No. of Sections:	Core Logged By:
Drive Length:	Attempt #:
Recovery:	Type of Core ☐ Mudmole ☐ Vibracore ☐ Diver Core
% Recovery:	Diameter of Core (inches)
Notes:	

Recovered Length (ft)	Size % Gravel	Size % Sand	Size % Fines	**Classification and Remarks** (Density, Moisture, Color, Minor Constituent, MAJOR Constituent, with Additional Constituents, Sheen, Odor)	Recovered Length (ft)	PID	Sample	Summary Sketch

PROJECT:	# Log of Boring No.
BORING LOCATION:	ELEVATION AND DATUM:
DRILLING CONTRACTOR:	DATE STARTED: / DATE COMPLETED:
DRILLING METHOD:	TOTAL DEPTH: / MEASURING POINT:
DRILLING EQUIPMENT:	DEPTH TO FIRST WATER ATD: / DEPTH TO FREE WATER ATC:
SAMPLING METHOD:	LOGGED BY:
BOREHOLE DIAMETER:	HAMMER TYPE/SYSTEM:

DEPTH (feet)	SAMPLES		PID Reading (ppm)	DESCRIPTION	FIELD-ESTIMATED %						SAMPLE ID OTHER REMARKS
					Gravel		Sand				
	Recovery	Blows/ 6 inches			Coarse	Fine	Coarse	Medium	Fine	Fines	

Project No.	ANCHOR QEA	Page 1 of ___

ED_006289_00009651-00228

PROJECT:

Log of Boring No.

DEPTH (feet)	SAMPLES		PID Reading (ppm)	DESCRIPTION	FIELD-ESTIMATED %						SAMPLE ID OTHER REMARKS
					Gravel		Sand				
	Recovery	Blows/ 6 inches			Coarse	Fine	Coarse	Medium	Fine	Fines	

Project No.

ANCHOR QEA

Page ___ of ___

Appendix C
Historical Data

Blymyer Engineers, Inc.

Exploratory Bore Log

Client: Matson Terminals
Site: Terminal 25 POS

Date: 12-1-88
Job#: 88289
Rig: Hollow Stem Auger
Diameter: 4"
Boring No.: B-10

Driller: Soil Sampling Service
Logged by: Sue Black

Description and Classification					Depth	Sample	Notes
Description and Remarks	Color	Blow Counts	Consist.	Soil Type			
Asphalt					1		
Fill - Medium Sand with Trace Fines, Little Gravel, Moist	Dark Gray	3-5-7	Loose	SM	5		Very Slight Solvent Odor (5 ppm)
Silty Clayey Sand, Wood Fragments, Gravels, Wet	Dark Gray/ Black	3-2-5	Loose	SC	10		Slight Hydro-carbon & Organic Odor (10 ppm)
							Bottom of Bore 10'
					15		
					20		
					25		
					30		

Blymyer Engineers, Inc.

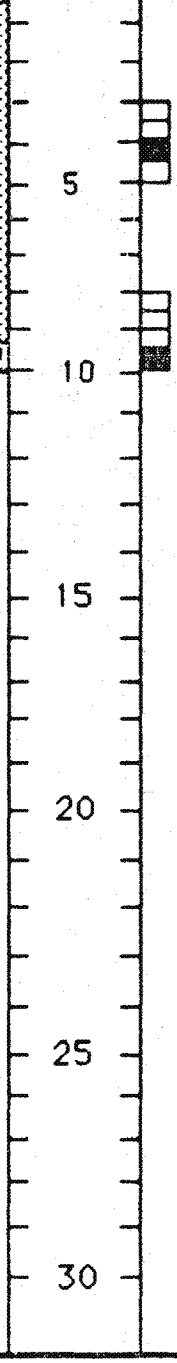
Exploratory Bore Log

Client: Matson Terminals
Site: Terminal 25 POS

Date: 12-1-88
Job#: 88289
Rig: Hollow Stem Auger
Diameter: 4"
Boring No.: B-11

Driller: Soil Sampling Service
Logged by: Sue Black

Description and Classification					Depth	Sample	Notes
Description and Remarks	Color	Blow Counts	Consist.	Soil Type			
Asphalt							
Fill- Medium to Coarse Sand, Trace Fines, Little Gravel, Moist	Light Gray	6-6-10	Medium Dense	SP			No Odor (0 ppm)
Silty Clay, Trace Sand, Organic, Wood Fragments, Wet	Black	1-1-1	Very Loose	OL	10		Organic Odor (0 ppm)
							Bottom of Bore 10'



Blymyer Engineers, Inc.

Exploratory Bore Log

Client: Matson Terminals
Site: Terminal 25 POS

Date: 12-1-88
Job#: 88289
Rig: Hollow Stem Auger
Diameter: 4"

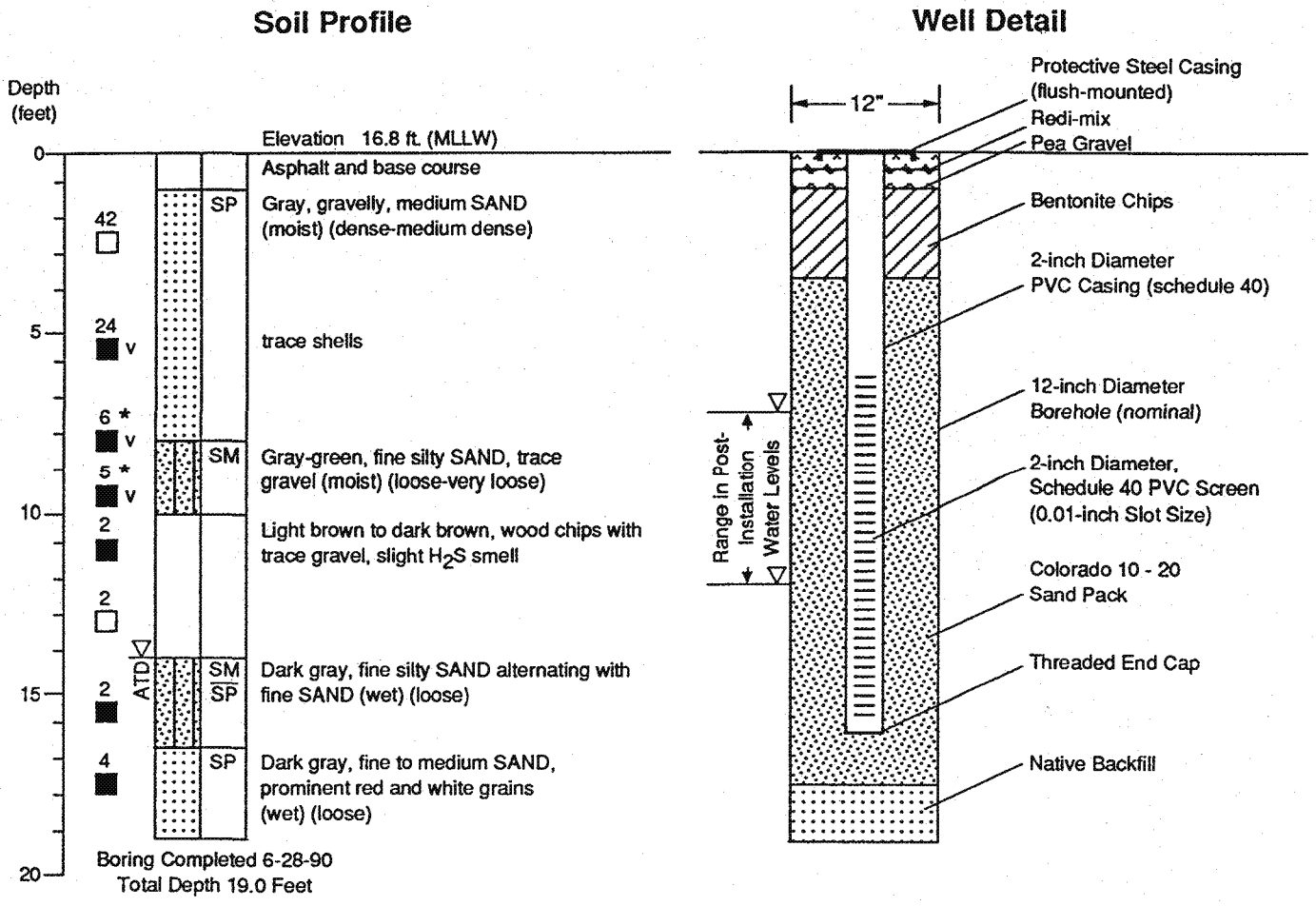
Driller: Soil Sampling Service
Logged by: Sue Black

Boring No.: B- 12

Description and Classification					Depth	Sample	Notes
Description and Remarks	Color	Blow Counts	Consist.	Soil Type			
Asphalt **Fill**- Medium to Coarse Sand, Trace Fines, Little Gravel, Moist	Light Gray	8-4-6	Medium Dense	SP			No Odor (0 ppm)
Silty Clay, Trace Sand, Organic, Wood Fragments, Wet	Black	1-2-1	Loose	OL			Organic Odor (0 ppm) Bottom of Bore 10'

5
10
15
20
25
30

Well LW-1



KEY

* ← Indicates sample collected for chemical analysis

102 ← Blows required to drive 2.42-inch I.D. split barrel sampler 1 foot with a hammer weight of 140 pounds and a stroke of 30 inches

■ ← Indicates depth at which relatively undisturbed sample was extracted

Relative Field UV Fluorescence Observations

V	Very weak
W	Weak
M	Moderate
(no symbol)	No fluorescence

☒ ← Indicates depth of disturbed sample

□ ← Indicates sample attempt with no recovery

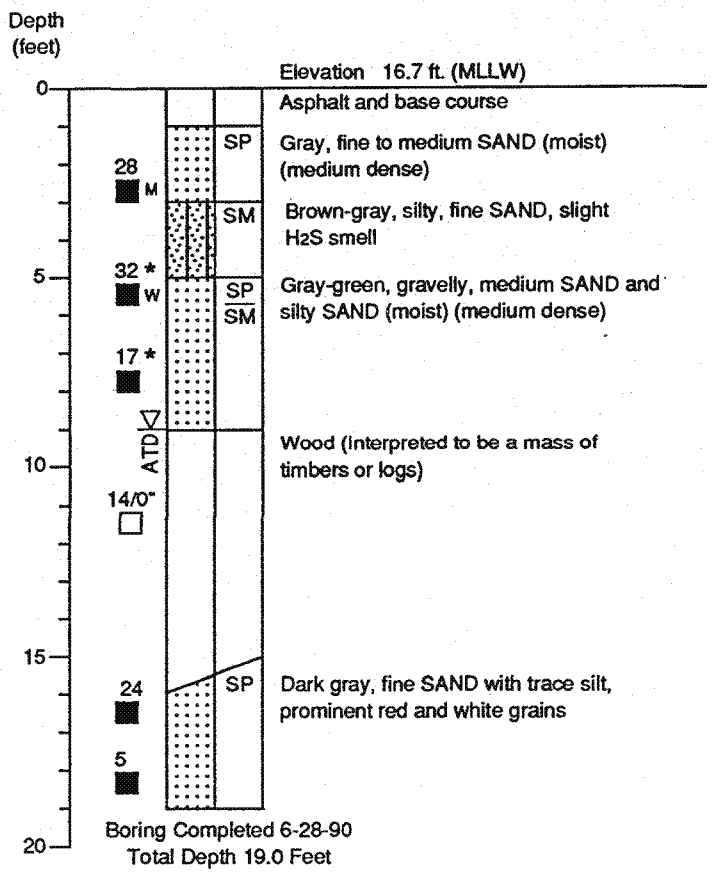
▽ ATD ← Water level encountered at time of drilling (Note: See text for subsequent ground water level measurements)

LANDAU ASSOCIATES, INC.	Soil Profile and Well Detail for Well LW-1

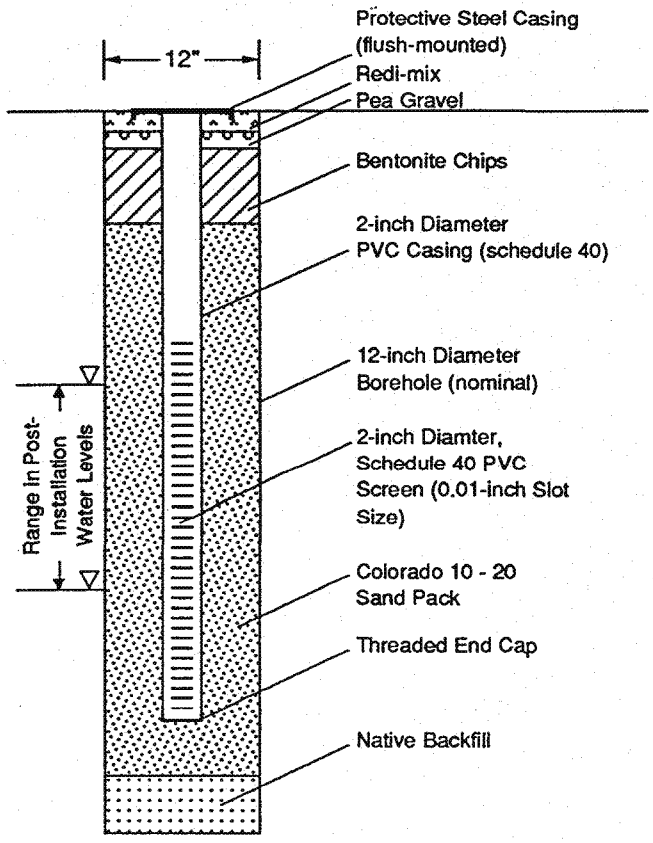
Figure A-2

Well LW-2

Soil Profile



Well Detail



KEY

* ← Indicates sample collected for chemical analysis

102 ← Blows required to drive 2.42-inch I.D. split barrel sampler 1 foot with a hammer weight of 140 pounds and a stroke of 30 inches

■ ← Indicates depth at which relatively undisturbed sample was extracted

Relative Field UV Fluorescence Observations

V	Very weak
W	Weak
M	Moderate
(no symbol)	No fluorescence

☒ ← Indicates depth of disturbed sample

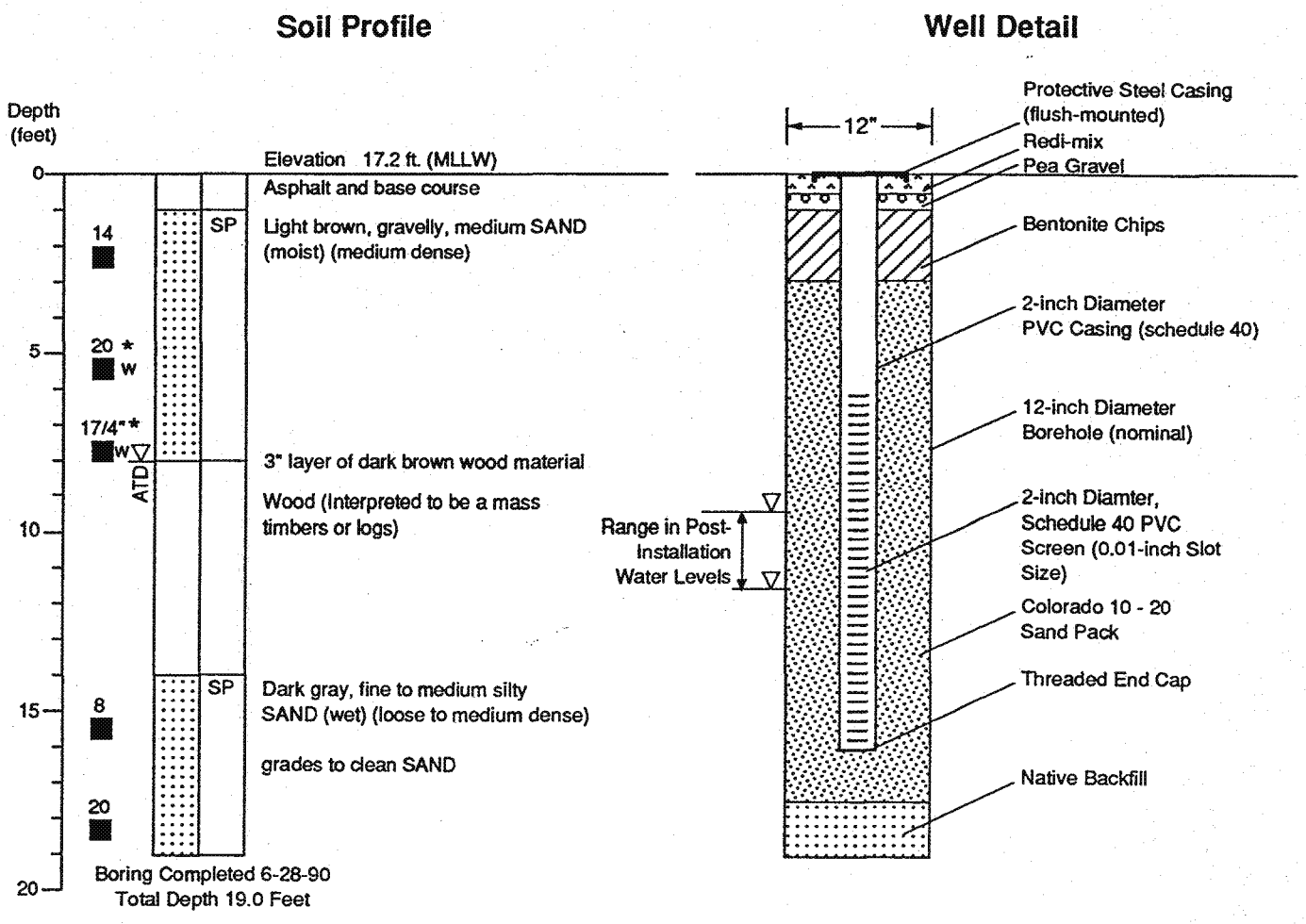
□ ← Indicates sample attempt with no recovery

▽ ATD ← Water level encountered at time of drilling (Note: See text for subsequent ground water level measurements)

LANDAU ASSOCIATES, INC.	Soil Profile and Well Detail for Well LW-2

Figure A-3

Well LW-3



KEY

* ← Indicates sample collected for chemical analysis

102 ↓ Blows required to drive 2.42-inch I.D. split barrel sampler 1 foot with a hammer weight of 140 pounds and a stroke of 30 inches

■ ← Indicates depth at which relatively undisturbed sample was extracted

Relative Field UV Fluorescence Observations

- V — Very weak
- W — Weak
- M — Moderate
- (no symbol) — No fluorescence

☒ ← Indicates depth of disturbed sample

□ ← Indicates sample attempt with no recovery

ATD ▽ ← Water level encountered at time of drilling (Note: See text for subsequent ground water level measurements)

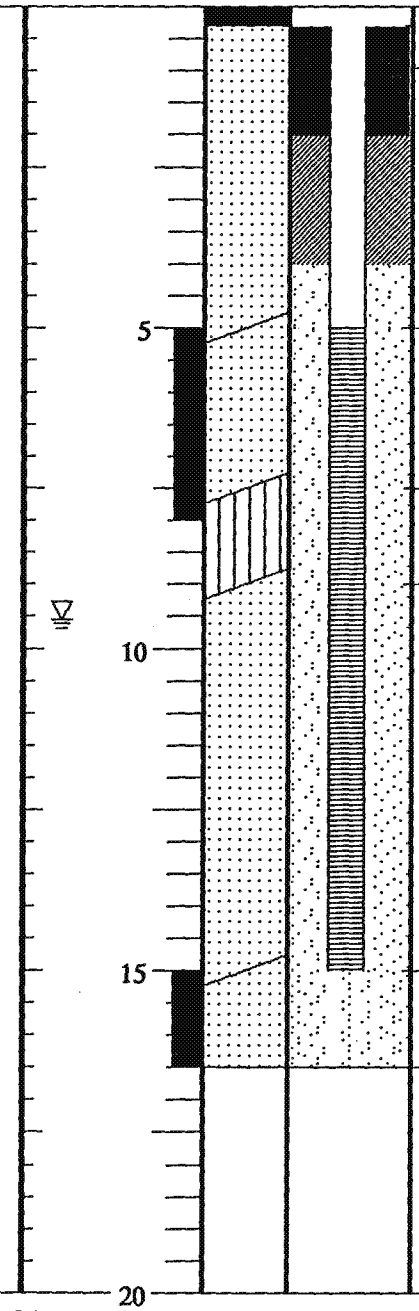
LANDAU ASSOCIATES, INC.	Soil Profile and Well Detail for Well LW-3

Figure A-4

LOG OF EXPLORATORY BORING

PROJECT NAME	Port of Seattle	BORING NO.	MW- 1
LOCATION	Terminal 25	PAGE	1 OF 1
DRILLED BY	GEO BORING	REFERENCE ELEV.	4.69' MSL
DRILL METHOD	4" ID HSA	TOTAL DEPTH	16.50'
LOGGED BY	John Guenther	DATE COMPLETED	10/12/89

SAMPLE TYPE AND NUMBER	TIP READING	BLOWS PER FOOT	LITHOLOGIC DESCRIPTION
			0 - 4 inches: ASPHALT Paving.
			4 inches - 5 feet: SAND, dark grey/brown. Trace fine gravel. Damp, wet wood odor.
SS 1	0	5	5 - 7.5 feet: SAND, grey brown; trace fines. Trace fine gravel. Damp, dense. Wet wood odor.
		18	
		32	
SS 2	< / = 21	20	
		27	
		39	
			7.5 - 9 feet: SANDY SILT, dark grey. 25-40 percent fine sand, saturated. Dense. No odor.
			9 - 15 feet: SILTY SAND, dark grey, fine sand, 10-20 percent silt, saturated. Dense. Wet wood odor.
SS 3	0	0	15 - 16.5 feet: SAWDUST - WOOD CHIPS, saturated, loose. Sulfer Odor.
		1	
		3	
			Bottom of boring at 16.5 feet.



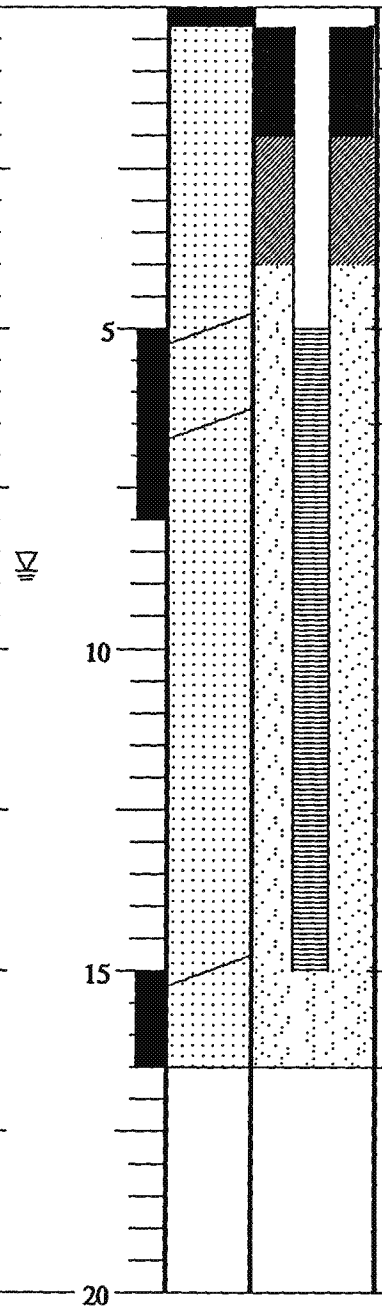
REMARKS

See attached legend for well construction details.

LOG OF EXPLORATORY BORING

PROJECT NAME	Port of Seattle	BORING NO.	MW-2
LOCATION	Terminal 25	PAGE	1 OF 1
DRILLED BY	GEO BORING	REFERENCE ELEV.	4.66' MSL
DRILL METHOD	4" ID HSA	TOTAL DEPTH	16.50'
LOGGED BY	John Guenther	DATE COMPLETED	10/12/89

SAMPLE TYPE AND NUMBER	TIP READING	BLOWS PER FOOT	LITHOLOGIC DESCRIPTION
			0 - 4 inches: ASPHALT Paving.
			4 inches - 5 feet: SAND, dark grey. Medium sand. Trace fines. Trace fine gravel. Damp, no odor.
SS 1	< / = 12	20 32 32	5 - 6.5 feet: SAND, dark grey, medium sand, trace fine gravel. Damp, dense. Slight wet wood odor.
SS 2	0	9 10 13	6.5 - 15 feet: SAND, grey, medium-coarse sand. Trace fine gravel. Saturated. Medium dense. No odor.
SS 3	0	1 0 0	15 - 16.5 feet: SAND; dark grey; fine to medium sand; trace silt. Loose, saturated. Wood chips. No Odor.
			Bottom of boring at 16.5 feet.



REMARKS

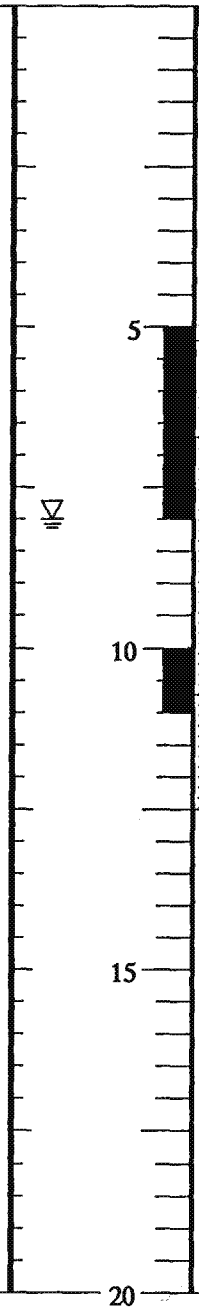
See attached legend for well construction details.

U57-01.01.SEATL.12/me:3.11/03

LOG OF EXPLORATORY BORING

PROJECT NAME	Port of Seattle	BORING NO.	MW- 3
LOCATION	Terminal 25	PAGE	1 OF 1
DRILLED BY	GEO BORING	REFERENCE ELEV.	3.84' MSL
DRILL METHOD	4" ID HSA	TOTAL DEPTH	12.50'
LOGGED BY	John Guenther	DATE COMPLETED	10/12/89

SAMPLE TYPE AND NUMBER	TIP READING	BLOWS PER FOOT	LITHOLOGIC DESCRIPTION
			0 - 4 inches: ASPHALT Paving.
			4 inches - 5 feet: SAND, dark grey/brown; medium sand, trace fines. Damp. Wet wood odor.
SS 1	0	8 26 17	5 - 6.5 feet: SAND, dark grey; fine to medium. Dense, moist, clean. No odor.
SS 2	0	5 8 13	6.5 - 10 feet: SAND, dark grey; fine to medium sand; trace to little silt. Saturated, medium dense. No odor.
SS 3	0	7 50	10.5 - 12.5 feet: WOOD CHUNKS AND SAWDUST; saturated, sulfer odor.
			Bottom of boring at 12.5 feet. Refusal on wood.



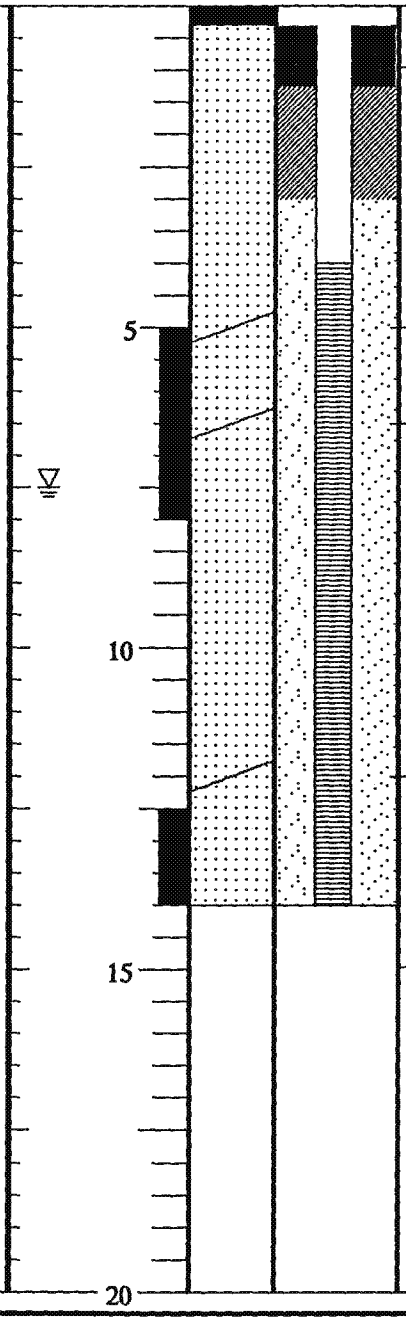
REMARKS

See attached legend for well construction details.

LOG OF EXPLORATORY BORING

PROJECT NAME	Port of Seattle	BORING NO.	MW- 4
LOCATION	Terminal 25	PAGE	1 OF 1
DRILLED BY	GEO BORING	REFERENCE ELEV.	4.09' MSL
DRILL METHOD	4" ID HSA	TOTAL DEPTH	14.00'
LOGGED BY	John Guenther	DATE COMPLETED	10/12/89

SAMPLE TYPE AND NUMBER	TIP READING	BLOWS PER FOOT	LITHOLOGIC DESCRIPTION
			0 - 4 inches: ASPHALT Paving.
			4 inches - 5 feet: SAND, dark grey, medium sand. Trace fine gravel. Damp, dense, wet wood odor.
SS 1	0	15 21 15	5 - 6.5 feet: SAND, grey; medium coarse sand, trace silt. Damp, dense. No odor.
SS 2	0	7 13 21	6.5 - 12 feet: SAND, grey, medium coarse sand. Saturated, dense. No odor.
SS 3	0	17 21 21	12 - 14 feet: SILTY SAND, dark brown/grey, fine sand, 10-20 percent silt. Saturated. Wood debris. 14 foot: Auger refusal in wood debris at 14 foot.
			Bottom of boring at 14 feet.



REMARKS

See attached legend for well construction details.

Total Depth:	81.5 ft.	Northing:		Drilling Method:	Mud Rotary	Hole Diam.:	
Top Elevation:	~	Easting:		Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	Mobile B-59	Hammer Type:	Automatic
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*

0 | 20 | 40 | 60

Dark brown, slightly gravelly to gravelly SAND, trace of silt; moist; SP. — 2.0

Very dense, gray, slightly sandy GRAVEL; moist; GP. — 7.0

Medium dense, slightly sandy WOOD; moist; PT. — 10.5

Loose, dark gray, slightly sandy to sandy SILT, trace of clay; moist; abundant wood; ML. — 12.0

Medium dense to loose, black with red flecks, slightly silty, fine to medium SAND, trace of silt; wet; scattered to abundant wood layers, scattered to abundant silt layers/seams; SP-SM.

During Drilling ▽

Medium stiff, gray-brown, slightly clayey SILT; moist; abundant organics; ML. — 31.0

50/2"

50/1"

5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45

CONTINUED NEXT SHEET

0 | 20 | 40 | 60

◇ % Fines (<0.075mm)

● % Water Content

LEGEND

* Sample Not Recovered

I Standard Penetration Test

▽ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Port of Seattle
Terminal 25 South Expansion - Phase 2
Seattle, Washington

LOG OF BORING B-1

October 2008 | 21-21044-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-2
Sheet 1 of 2

REV 1

MASTER LOG E 21-21044.GPJ SHAN_WIL.GDT 10/22/08 Log: ELM Rev: MDH Typ: CL,P

Total Depth:	81.5 ft.	Northing:		Drilling Method:	Mud Rotary	Hole Diam.:	
Top Elevation:	~	Easting:		Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	Mobile B-59	Hammer Type:	Automatic
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

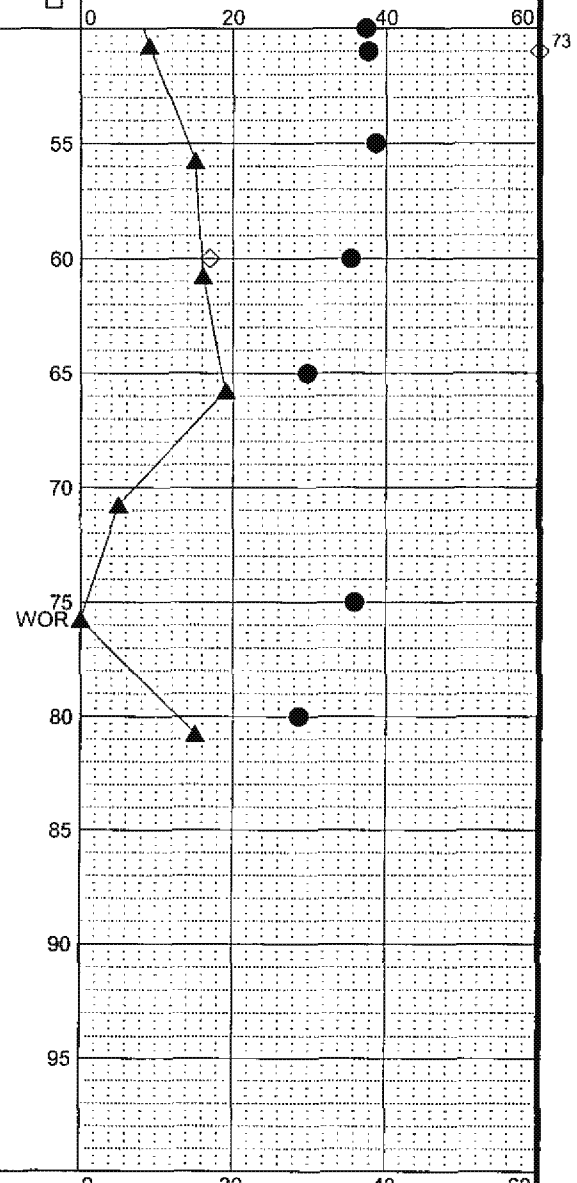
Depth, ft.	Soil Description
50.0	Loose, black with red flecks, slightly silty, fine to medium SAND; wet; abundant organics; SP.
51.0	
54.0	Medium stiff, gray-brown, clayey SILT; moist to very moist; ML-MH.
	Medium dense, black with red flecks, slightly silty to silty, fine to medium SAND and gray-brown SILT; moist to wet; scattered to abundant organics; SP-SM/ML.
64.0	Medium dense, black with red flecks, slightly silty to silty SAND; moist to wet; scattered organics; SP-SM.
68.0	Very soft, gray-brown, silty CLAY/clayey SILT; moist; scattered organics; CL-ML.
78.0	Medium dense, black with red flecks, slightly silty, fine to medium SAND and gray-brown SILT; moist to wet; SP/ML.
81.5	BOTTOM OF BORING COMPLETED 10/6/2008

Symbol / Samples: 14, 15, 16, 17, 18, 19, 20

Ground Water Depth, ft.: WOR

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



LEGEND

* Sample Not Recovered

I Standard Penetration Test

▽ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Port of Seattle
Terminal 25 South Expansion - Phase 2
Seattle, Washington

LOG OF BORING B-1

October 2008 | 21-21044-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-2
Sheet 2 of 2

REV 1

MASTER LOG E 21-21044.GPJ SHAN_WIL.GDT 10/22/08 Log: ELM Rev: MDH Typ: CLP

Total Depth:	81.5 ft.	Northing:		Drilling Method:	Mud Rotary	Hole Diam.:	
Top Elevation:	~	Easting:		Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	Mobile B-59	Hammer Type:	Automatic
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Dark brown, slightly gravelly to gravelly SAND, trace of silt; moist; SP. — 2.0

Very dense, gray, slightly sandy GRAVEL; moist; GP. — 7.0

Medium dense, slightly sandy WOOD; moist; PT. — 10.5

Loose, dark gray, slightly sandy to sandy SILT, trace of clay; moist; abundant wood; ML. — 12.0

Medium dense to loose, black with red flecks, slightly silty, fine to medium SAND, trace of silt; wet; scattered to abundant wood layers, scattered to abundant silt layers/seams; SP-SM.

Medium stiff, gray-brown, slightly clayey SILT; moist; abundant organics; ML. — 31.0

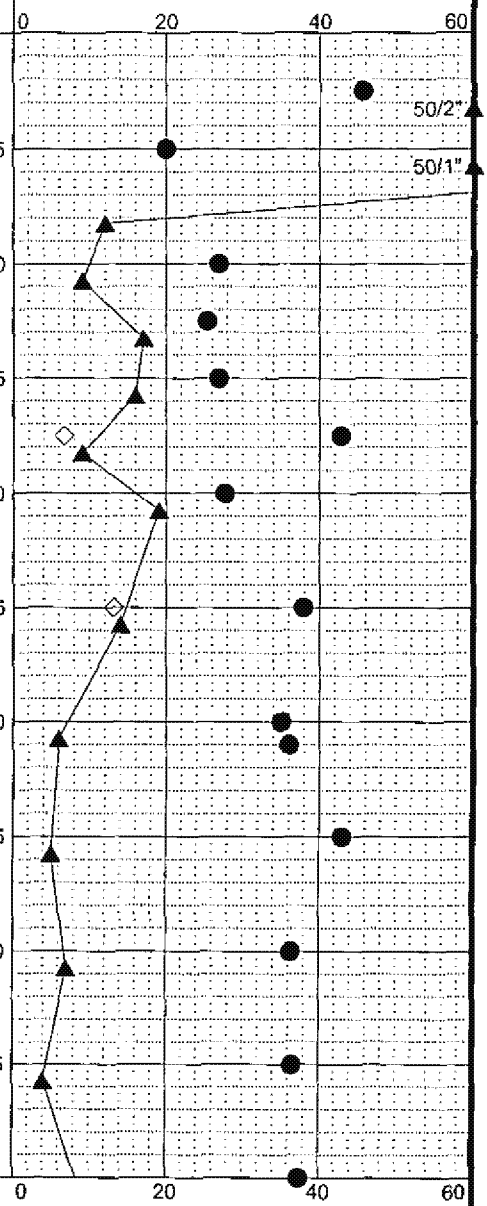
CONTINUED NEXT SHEET

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

During Drilling

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



LEGEND

* Sample Not Recovered

I Standard Penetration Test

▽ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
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Port of Seattle
Terminal 25 South Expansion - Phase 2
Seattle, Washington

LOG OF BORING B-1

October 2008 | 21-21044-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-2
Sheet 1 of 2

REV 1

MASTER LOG E 21-21044.GPJ SHAN_WIL.GDT 10/22/08 Log: ELM Rev: MDH Typ: CL,P

Total Depth:	81.5 ft.	Northing:		Drilling Method:	Mud Rotary	Hole Diam.:	
Top Elevation:	~	Easting:		Drilling Company:	Boart Longyear	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	Mobile B-59	Hammer Type:	Automatic
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

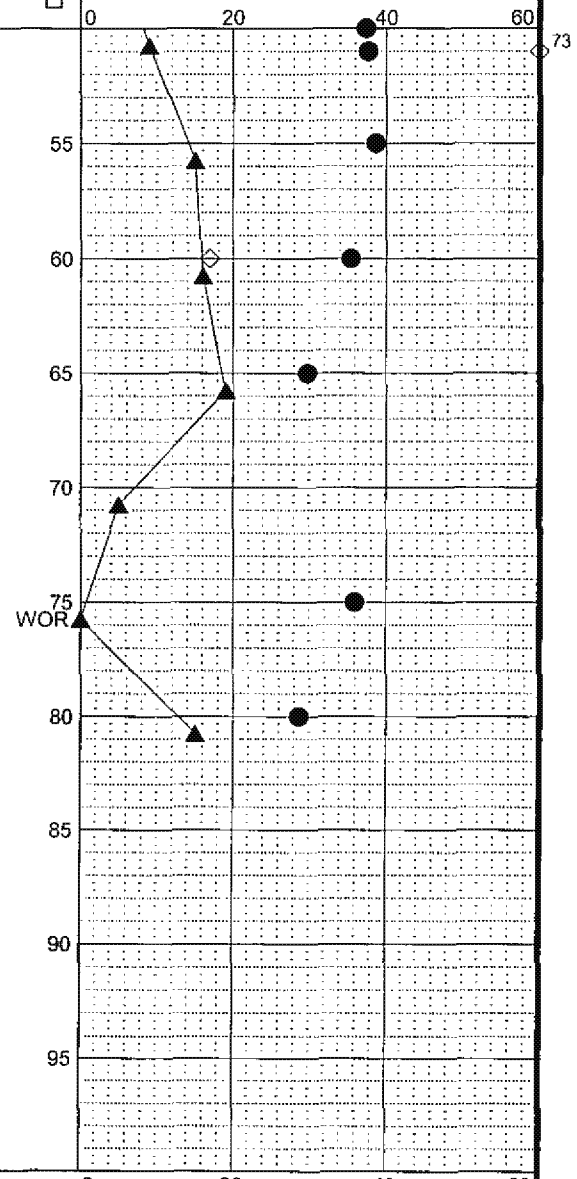
Depth, ft.	Soil Description
50.0	Loose, black with red flecks, slightly silty, fine to medium SAND; wet; abundant organics; SP.
51.0	
54.0	Medium stiff, gray-brown, clayey SILT; moist to very moist; ML-MH.
	Medium dense, black with red flecks, slightly silty to silty, fine to medium SAND and gray-brown SILT; moist to wet; scattered to abundant organics; SP-SM/ML.
64.0	Medium dense, black with red flecks, slightly silty to silty SAND; moist to wet; scattered organics; SP-SM.
68.0	Very soft, gray-brown, silty CLAY/clayey SILT; moist; scattered organics; CL-ML.
78.0	Medium dense, black with red flecks, slightly silty, fine to medium SAND and gray-brown SILT; moist to wet; SP/ML.
81.5	BOTTOM OF BORING COMPLETED 10/6/2008

Symbol | Samples: 14, 15, 16, 17, 18, 19, 20

Ground Water Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



LEGEND

* Sample Not Recovered

I Standard Penetration Test

▽ Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Port of Seattle
Terminal 25 South Expansion - Phase 2
Seattle, Washington

LOG OF BORING B-1

October 2008 | 21-21044-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-2
Sheet 2 of 2

REV 1

MASTER LOG E 21-21044.GPJ SHAN_WIL.GDT 10/22/08 Log: ELM Rev: MDH Typ: CLP

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
110003-01	AQ-MW-1	1 of 1

Project Name:	Terminal 25-S	Ground Surface Elev	
Location:	Seattle, Washington	Top of Casing Elev.	12.54
Driller/Method:	Cascade-Lynn / Geoprobe truck rig	Depth to Water (ft BGS)	5
Sampling Method:	Continuous	Start/Finish Date	10/21/2012

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
	5"-diameter monument mounted flush in concrete			0			**FILL** Slightly moist, gray, black, and brown, silty, sandy GRAVEL (GM); crushed rock, asphalt debris	
	3/4"-diameter Sch 40 PVC riser			0				
5				0			Moist to wet, brown to dark brown, silty SAND (SM); well-graded fine-to-coarse sand	5
	Hydrated bentonite chips			0			Wood debris	
10				0				10
	10-20 sand			0				
15	3/4"-diameter 0.020"-slot Sch 40 PVC screen prepacked with 10-20 sand			0			**HOLOCENE ALLUVIUM** Wet, black, slightly silty SAND (SP-SM); poorly graded fine-to-medium sand, rare red clasts	15
	Slip cap			0				
	Slough			0				
20							Bottom of boring at 20 ft, Water level datum is MLLW Epoch 1983-2001	20

Sampler Type:
- No Recovery
- Continuous Core

PID - Photoionization Detector
- Static Water Level
- Water Level (ATD)

Logged by: Mv

Approved by: SJG

Figure No. A- 2

_MONITORING WELL T-25S.GPJ September 18, 2012

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
110003-01	AQ-MW-2	1 of 1

Project Name:	Terminal 25-S	Ground Surface Elev	
Location:	Seattle, Washington	Top of Casing Elev.	16.3
Driller/Method:	Cascade-Lynn / Geoprobe truck rig	Depth to Water (ft BGS)	7.2
Sampling Method:	Continuous	Start/Finish Date	10/21/2012

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
	5"-diameter monument mounted flush in concrete			0			Asphalt	
							FILL	
				0			Slightly moist, gray, black, and brown, silty, sandy GRAVEL (GM); crushed rock, base course	
	3/4"-diameter Sch 40 PVC riser			0			Moist to wet, brown to dark brown, slightly silty, gravelly SAND (SM); well-graded fine-to-coarse sand	
				0				
5	Hydrated bentonite chips			0				5
				0				
				0				
				0			Wet, brown and dark gray, silty SAND (SM); abundant wood debris	
				0				
10				0				10
				0				
				0				
				0				
	10-20 sand			0				
				0			**HOLOCENE ALLUVIUM**	
15				0			Wet, black, slightly silty SAND (SP-SM); poorly graded fine-to-medium sand, rare red clasts	15
	3/4"-diameter 0.020"-slot Sch 40 PVC screen prepacked with 10-20 sand			0				
				0				
				0				
	Slip cap			0				
20							Bottom of boring at 20 ft,	20
							Water level datum is MLLW Epoch 1983-2001	

Sampler Type:
- ○ No Recovery
- ▌▌ Continuous Core

PID - Photoionization Detector
- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: Mv

Approved by: SJG

Figure No. A- 3

_MONITORING WELL T-25S.GPJ September 18, 2012

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
110003-01	AQ-MW-3	1 of 1

Project Name:	Terminal 25-S	Ground Surface Elev	
Location:	Seattle, Washington	Top of Casing Elev.	16.66
Driller/Method:	Cascade-Lynn / Geoprobe truck rig	Depth to Water (ft BGS)	7.5
Sampling Method:	Continuous	Start/Finish Date	10/21/2012

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
	5"-diameter monument mounted flush in concrete			0			Asphalt	
							FILL Slightly moist, gray, black, and brown, silty, sandy GRAVEL (GM); crushed rock (base course)	
				0			Moist to wet, brown to dark brown, slightly silty, gravelly SAND (SM); poorly graded fine-to-medium sand	
	3/4"-diameter Sch 40 PVC riser			0			Seashell fragments	
				0				
5	Hydrated bentonite chips			0				5
				0				
				0				
				0			Becomes wet	
				0				
				0				
10				0			Sulfide-like odor	10
				0			Wood debris	
				0				
				0				
	10-20 sand			0			Wet, brown, silty SAND (SM)	
15				0				15
				0				
	3/4"-diameter 0.020"-slot Sch 40 PVC screen prepacked with 10-20 sand			0			**HOLOCENE ALLUVIUM** Wet, black, slightly silty SAND (SP-SM); poorly graded fine-to-medium sand, rare red clasts	
				0				
	Slip cap			0				
20							Bottom of boring at 20 ft,	20
							Water level datum is MLLW Epoch 1983-2001	

Sampler Type:
- No Recovery
- Continuous Core

PID - Photoionization Detector
- Static Water Level
- Water Level (ATD)

Logged by: Mv

Approved by: SJG

Figure No. A- 4

_MONITORING WELL T-25S.GPJ September 18, 2012

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
110003-01	AQ-MW-4	1 of 1

Project Name:	Terminal 25-S	Ground Surface Elev	
Location:	Seattle, Washington	Top of Casing Elev.	17.03
Driller/Method:	Cascade-Lynn / Geoprobe truck rig	Depth to Water (ft BGS)	7
Sampling Method:	Continuous	Start/Finish Date	10/21/2012

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
	5"-diameter monument mounted flush in concrete			0			Asphalt	
							FILL	
				0			Slightly moist, gray, black, and brown, silty, sandy GRAVEL (GM); crushed rock (base course)	
				0			Moist to wet, brown to dark brown, slightly silty, gravelly SAND (SM); poorly graded fine-to-medium sand	
	3/4"-diameter Sch 40 PVC riser			0				
				0				
5	Hydrated bentonite chips			0				5
				0			Brick debris	
				0			Becomes wet, silty.	
				0			Abundant woody debris	
				0				
10				0			Sulfide-like odor	10
				0			Wood debris	
				0				
				0				
	10-20 sand			0				
15				0			Wet, brown, silty SAND (SM)	15
				0				
	3/4"-diameter 0.020"-slot Sch 40 PVC screen prepacked with 10-20 sand			0			**HOLOCENE ALLUVIUM**	
				0			Wet, black, slightly silty SAND (SP-SM); poorly graded fine-to-medium sand, rare red clasts	
				0				
	Slip cap							
20							Bottom of boring at 20 ft,	20
							Water level datum is MLLW Epoch 1983-2001	

Sampler Type:
- No Recovery
- Continuous Core

PID - Photoionization Detector
- Static Water Level
- Water Level (ATD)

Logged by: Mv

Approved by: SJG

Figure No. A- 5

_MONITORING WELL T-25S.GPJ September 18, 2012

Sediment Core Log

CORE: EW10-SC06

Project: **East Waterway SRI/FS**	Location: **East Waterway**	Tube Length (ft): **14.55**
Project #: **060003-01.17**	Water Elevation (ft)/Tide: **8.3**	Penetration Depth (ft): **14.35**
Client: **Port of Seattle**	Water Depth (ft): **36.3**	Recovery Length (ft): **11.55**
Collection Date: **2/22/2010**	Surveyed Mudline Elevation (ft): **-29.4**	Process Date: **2/23/2010**
Contractor: **AMEC**	N/LAT: **47 34.3570 N** E/LONG: **122 20.6736 W**	Process Method: **Cut tube**
Vessel: **R/V Investigator**	Horiz. Datum: **WGS 84** Vert. Datum: **MLLW**	Sample Quality: **Good**
Operator: **Gary Maxwell**	Method/Tube ID: **MudMole/3.88" sq**	Logged By: **LM/AO**

Recoverd Detph (ft)	Recovered Interval & Sample	Geotech Sample	Chemical Analysis	PID Measurement	**Sediment Description** (Samples and Descriptions are in Recovered Depths; In-Situ Depths Shown on Right; Classification Scheme: USCS)	*In-situ* Depth (ft) & Graphic Log
0	EW10-SC06-0-2		SVOC, PCB, Metals, TOC/TS, GS, Butyltins	2	(ML) Moist, soft, black, clayey SILT, trace f-sand, trace subrounded f-gravel (1/2"-diameter). Silt is smooth and homogenous. Trace wood fragments and twigs, trace shell fragments. Moderate H2S odor.	Recent
1					@ 1.8': Piece of glass, wood fragment (2.5"-long, cedar)	
2				69.9	@ 2': Thin bed of f-sandy, SILT (ML)	
	EW10-SC06-2-4		SVOC, PCB, Metals, TOC/TS, GS, Butyltins		(SP) Moist, medium dense, black, f-SAND. Sand grains are multicolored and are red, beige, black, white, and gray.	
3				72	(ML) Moist, medium stiff, olive gray, SILT. Substantial decomposed wood fragments (3"-long, brown). Moderate H2S odor.	
4				170		
	EW10-SC06-4-6		Mercury		@ 4.8': Wood piece (3"x 3"-wide)	Transition
5				78	@ 5.1': Grades to damp, slightly clayey, SILT. Silt has a blocky texture. Occasional wood fragments, trace wood fibers (hair-like)	
6				31		
	EW10-SC06-6-7.4		Mercury	7.8		
7				0	@ 6.9': Grades to slightly f-sandy, SILT. Trace wood fragments	
	EW10-SC06-7				(SP) Damp, dense, dark gray, f-SAND and occasional pockets and stratified beds of SILT (ML) Moderate wood fragments (1"-long).	
8						

ANCHOR QEA
1423 Third Avenue
Seattle, WA 98101
206-287-9130

Footnote(1): Attempt 1 of 1

Footnote (2):

Calculated Recovery
Recovery Length/Penetration Depth:
11.55/14.35 ft 80.5%

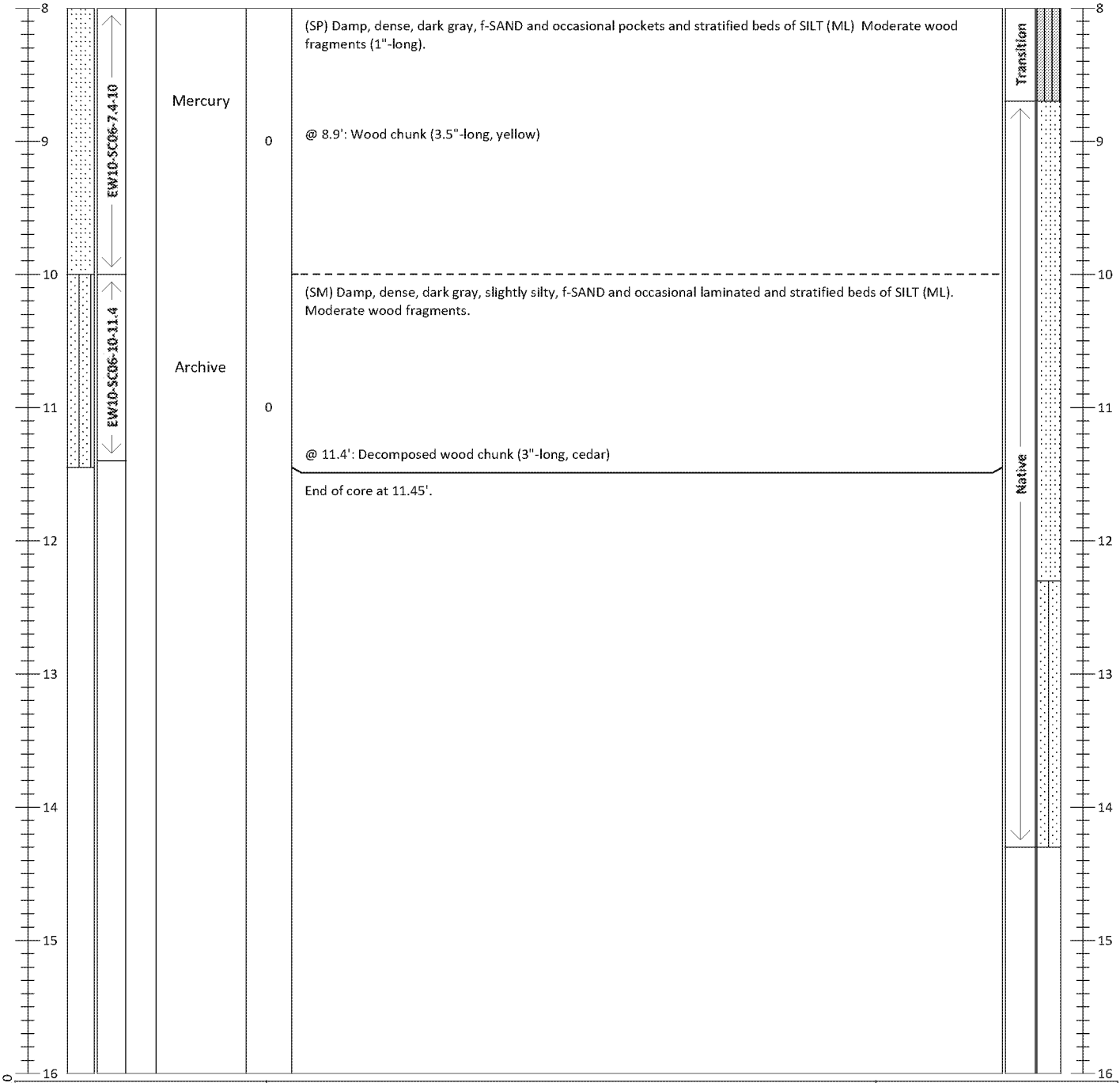
Revised 6-16-2010

Sediment Core Log

CORE: EW10-SC06

Project: **East Waterway SRI/FS**	Location: **East Waterway**	Tube Length (ft): **14.55**
Project #: **060003-01.17**	Water Elevation (ft)/Tide: **8.3**	Penetration Depth (ft): **14.35**
Client: **Port of Seattle**	Water Depth (ft): **36.3**	Recovery Length (ft): **11.55**
Collection Date: **2/22/2010**	Surveyed Mudline Elevation (ft): **-29.4**	Process Date: **2/23/2010**
Contractor: **AMEC**	N/LAT: **47 34.3570 N** E/LONG: **122 20.6736 W**	Process Method: **Cut tube**
Vessel: **R/V Investigator**	Horiz. Datum: **WGS 84** Vert. Datum: **MLLW**	Sample Quality: **Good**
Operator: **Gary Maxwell**	Method/Tube ID: **MudMole/3.88" sq**	Logged By: **LM/AO**

Recoverd Detph (ft)	Recovered Interval & Sample	Geotech Sample	Chemical Analysis	PID Measurement	**Sediment Description** Samples and Descriptions are in Recovered Depths In-Situ Depths Shown on Right Classification Scheme: USCS	*In-situ* Depth (ft) & Graphic Log
	EW10-SC06-7.4-10		Mercury	0	(SP) Damp, dense, dark gray, f-SAND and occasional pockets and stratified beds of SILT (ML) Moderate wood fragments (1"-long). @ 8.9': Wood chunk (3.5"-long, yellow)	Transition
	EW10-SC06-10-11.4		Archive	0	(SM) Damp, dense, dark gray, slightly silty, f-SAND and occasional laminated and stratified beds of SILT (ML). Moderate wood fragments. @ 11.4': Decomposed wood chunk (3"-long, cedar) End of core at 11.45'.	Native



ANCHOR QEA
1423 Third Avenue
Seattle, WA 98101
206-287-9130

Footnote(1): Attempt 1 of 1

Footnote (2):

Calculated Recovery
Recovery Length/Penetration Depth:
11.55/14.35 ft 80.5%

Revised 6-16-2010

Sediment Core Log

CORE: EW10-SC08

Project: **East Waterway SRI/FS**	Location: **East Waterway**	Tube Length (ft): **14.55**
Project #: **060003-01.17**	Water Elevation (ft)/Tide: **10.1**	Penetration Depth (ft): **14.32**
Client: **Port of Seattle**	Water Depth (ft): **45.4**	Recovery Length (ft): **12.32**
Collection Date: **2/22/2010**	Surveyed Mudline Elevation (ft): **-36.1**	Process Date: **2/23/2010**
Contractor: **AMEC**	N/LAT: **47 34.4087 N** E/LONG: **122 20.6430 W**	Process Method: **Cut tube**
Vessel: **R/V Investigator**	Horiz. Datum: **WGS 84** Vert. Datum: **MLLW**	Sample Quality: **Good**
Operator: **Gary Maxwell**	Method/Tube ID: **MudMole/3.88" sq**	Logged By: **LM/AO**

Recoverd Detph (ft)	Recovered Interval & Sample	Geotech Sample	Chemical Analysis	PID Measurement	**Sediment Description** Samples and Descriptions are in Recovered Depths In-Situ Depths Shown on Right Classification Scheme: USCS	*In-situ* Depth (ft) & Graphic Log
0–2	EW10-SC08-0-2		SVOC, PCB, Metals, TOC/TS, GS	0.1	(ML) Moist, medium stiff, black with olive gray mottling, slightly sandy, very clayey SILT. Silt is smooth and homogenous. Trace biota (worm) and rootlets. Moderate H2S odor.	
2–4	EW10-SC08-2-4		SVOC, PCB, Metals, TOC/TS, GS	15.2	@ 2': Grades to soft @ 2.5': Grades to blocky. Trace shell fragments. Trace metallic sheen and moderate HC-like odor.	
4–6	EW10-SC08-4-6		Archive	1.7 0	(ML) Moist, soft, olive gray, slightly clayey, SILT. Silt is smooth and homogeneous. Trace fresh wood fragments (1"-long, yellow/brown). Trace HC-like odor. @ 6': Bone piece (2.5"-long)	
6–8	EW10-SC08-6-8		SVOC, PCB, Mercury, Cadmium	0		

Recent

Revised 6-16-2010

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Footnote(1): Attempt 1 of 1

Footnote (2):

Calculated Recovery
Recovery Length/Penetration Depth:
12.32/14.32 ft = 86.0%

Sediment Core Log

CORE: EW10-SC08

Project: **East Waterway SRI/FS**	Location: **East Waterway**	Tube Length (ft): **14.55**
Project #: **060003-01.17**	Water Elevation (ft)/Tide: **10.1**	Penetration Depth (ft): **14.32**
Client: **Port of Seattle**	Water Depth (ft): **45.4**	Recovery Length (ft): **12.32**
Collection Date: **2/22/2010**	Surveyed Mudline Elevation (ft): **-36.1**	Process Date: **2/23/2010**
Contractor: **AMEC**	N/LAT: **47 34.4087 N** E/LONG: **122 20.6430 W**	Process Method: **Cut tube**
Vessel: **R/V Investigator**	Horiz. Datum: **WGS 84** Vert. Datum: **MLLW**	Sample Quality: **Good**
Operator: **Gary Maxwell**	Method/Tube ID: **MudMole/3.88" sq**	Logged By: **LM/AO**

Recoverd Detph (ft)	Recovered Interval & Sample	Geotech Sample	Chemical Analysis	PID Measurement	**Sediment Description** Samples and Descriptions are in Recovered Depths In-Situ Depths Shown on Right Classification Scheme: USCS	*In-situ* Depth (ft) & Graphic Log
	EW10-SC08-8-9.4		Mercury	0	(SM) Damp, medium dense, dark gray, slightly silty, f-SAND and trace pockets and laminated beds of SILT (ML). Sand grains are multicolored and are red, beige, black, white, and gray. Occasional decomposed wood fragments (1"-long, cedar) and layers of wood fragments (1/16"-long).	Recent
	EW10-SC08-9.4-11		Mercury	0	(SP) Moist, medium dense, dark gray, f-SAND.	Native
	EW10-SC08-11-12.5		Archive	0	(ML) Moist, soft, light gray, SILT. (SP) Moist, medium dense, dark gray, f-SAND. @ 12.4': Winnowing to end of core End of core at 12.65'.	

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Footnote(1): Attempt 1 of 1

Footnote (2):

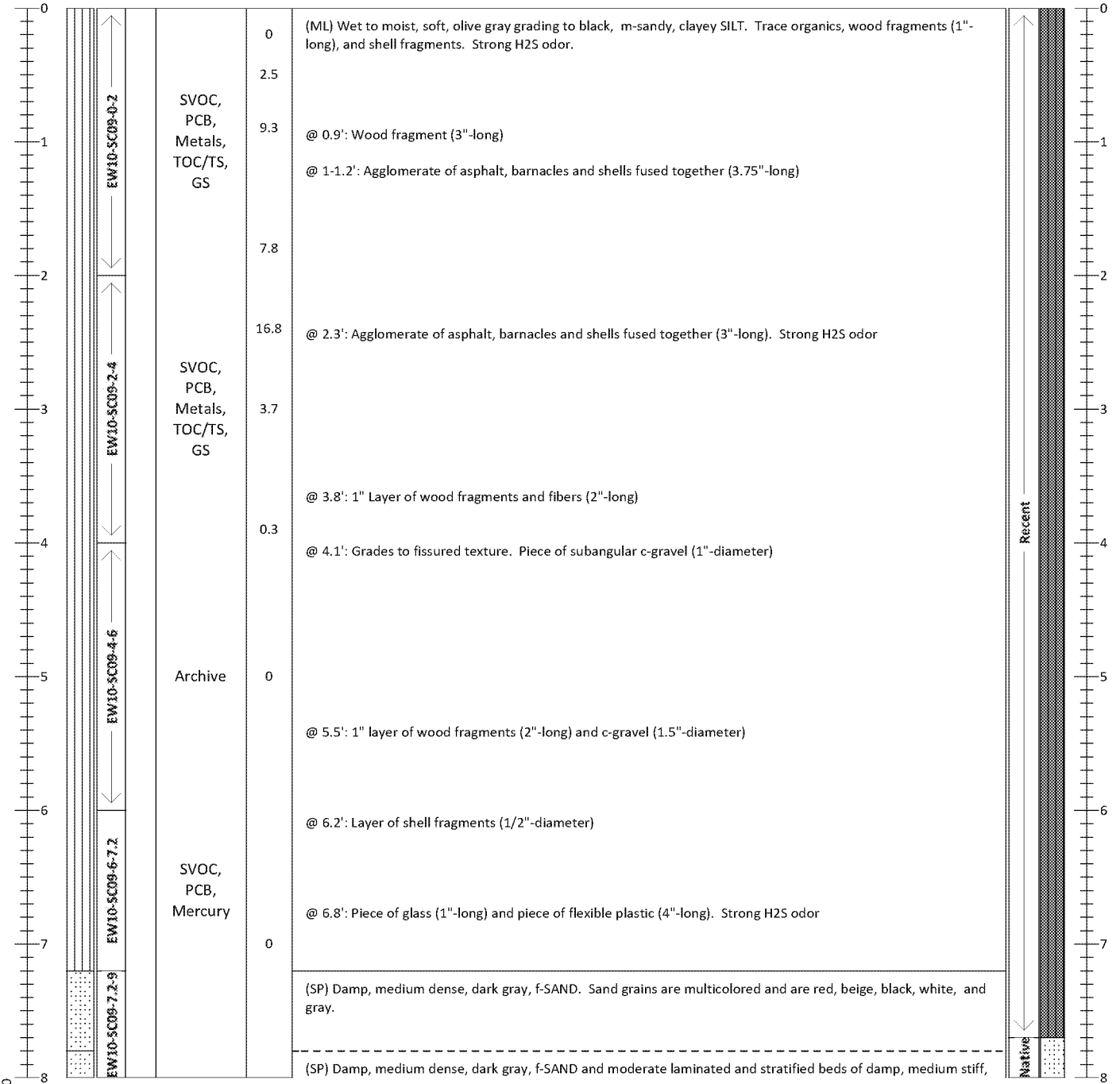
Calculated Recovery
Recovery Length/Penetration Depth:
12.32/14.32 ft = 86.0%

Revised 6-16-2010

Sediment Core Log

CORE: EW10-SC09

Project: **East Waterway SRI/FS**	Location: **East Waterway**	Tube Length (ft): **15**
Project #: **060003-01.17**	Water Elevation (ft)/Tide: **8.2**	Penetration Depth (ft): **14**
Client: **Port of Seattle**	Water Depth (ft): **46.3**	Recovery Length (ft): **13.1**
Collection Date: **3/8/2010**	Surveyed Mudline Elevation (ft): **-40.4**	Process Date: **3/9/2010**
Contractor: **MSS**	N/LAT: **47 34.4207 N** E/LONG: **122 20.5875 W**	Process Method: **Cut tube**
Vessel: **R/V Nancy Anne**	Horiz. Datum: **WGS 84** Vert. Datum: **MLLW**	Sample Quality: **Good**
Operator: **Bill Jaworski**	Method/Tube ID: **Vibracore/3.75" round**	Logged By: **LM/ML**



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Footnote(1): Attempt 1 of 1

Footnote (2):

Calculated Recovery

Recovery Length/Penetration Depth:

13.1/14 ft = 93.6%

Revised 6-16-2010

Sediment Core Log

CORE: EW10-SC09

Project: **East Waterway SRI/FS**	Location: **East Waterway**	Tube Length (ft): **15**
Project #: **060003-01.17**	Water Elevation (ft)/Tide: **8.2**	Penetration Depth (ft): **14**
Client: **Port of Seattle**	Water Depth (ft): **46.3**	Recovery Length (ft): **13.1**
Collection Date: **3/8/2010**	Surveyed Mudline Elevation (ft): **-40.4**	Process Date: **3/9/2010**
Contractor: **MSS**	N/LAT: **47 34.4207 N** E/LONG: **122 20.5875 W**	Process Method: **Cut tube**
Vessel: **R/V Nancy Anne**	Horiz. Datum: **WGS 84** Vert. Datum: **MLLW**	Sample Quality: **Good**
Operator: **Bill Jaworski**	Method/Tube ID: **Vibracore/3.75" round**	Logged By: **LM/ML**

Recoverd Detph (ft)	Recovered Interval & Sample	Geotech Sample	Chemical Analysis	PID Measurement	**Sediment Description** Samples and Descriptions are in Recovered Depths In-Situ Depths Shown on Right Classification Scheme: USCS	*In-situ* Depth (ft) & Graphic Log
	EW10-SC09-7.2-9.2		Mercury	0	(SP) Damp, medium dense, dark gray, f-SAND and moderate laminated and stratified beds of damp, medium stiff, olive gray, SILT (ML). Sand grains are multicolored and are red, beige, black, white, and gray.	Native
	EW10-SC09-9.2-11.2		Mercury	0		
	EW10-SC09-11.2-12.5		Archive		@ 11.8': Grades to trace fresh wood fragments (1/2"-long, orange)	
					End of core at 12.5'.	

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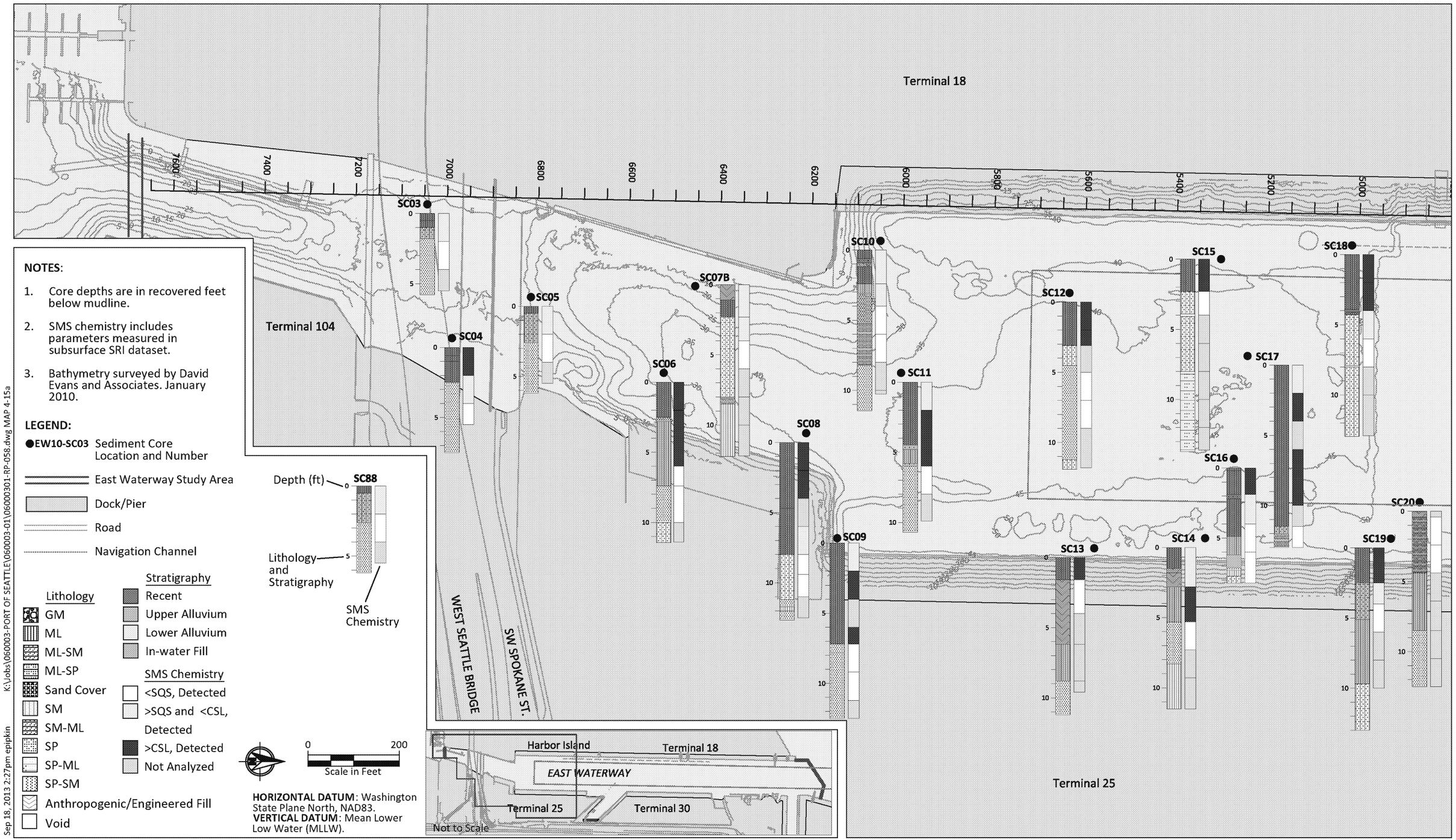
Footnote(1): Attempt 1 of 1

Footnote (2):

Calculated Recovery
Recovery Length/Penetration Depth:
13.1/14 ft = 93.6%

Revised 6-16-2010



K:\Jobs\060003-PORT OF SEATTLE\060003-01\060003-01060000301-RP-058.dwg MAP 4-15a
Sep 18, 2013 2:27pm epipkin

Map 4-15a
Subsurface Sediment Core Profiles with SMS Chemistry
Supplemental Remedial Investigation
East Waterway Operable Unit

ED_006289_00009651-00255

East Waterway Surface Sediment Chemistry

Chemical	Unit	EW09-SS-015-010 6/23/2009	EW09-SS-016-010 6/22/2009	EW09-SS-018-010 6/22/2009	EW09-SS-020-010 3/4/2009	EW10-04-COMP 8/19/2009	EW10-05-COMP 8/19/2009	EW10-06-COMP 8/19/2009
Metals								
Antimony	mg/kg dw	20 UJ	7 UJ	20 UJ	10 UJ	--	--	--
Arsenic	mg/kg dw	8.2	4.8	5.8	12.9	--	--	--
Cadmium	mg/kg dw	0.8 U	0.3 U	0.7 U	0.8	--	--	--
Chromium	mg/kg dw	23	33.6	25	34	--	--	--
Cobalt	mg/kg dw	5	6.6 J	6 J	8.1	--	--	--
Copper	mg/kg dw	43.9	38.6 J	35.2	83.9	--	--	--
Lead	mg/kg dw	32	35 J	88 J	54	--	--	--
Mercury	mg/kg dw	0.11 J	0.08	0.11	0.75 J	--	--	--
Molybdenum	mg/kg dw	3	2.7 J	4 J	1 UJ	--	--	--
Nickel	mg/kg dw	15	26	20	21	--	--	--
Selenium	mg/kg dw	0.8 U	0.7 U	0.7 U	1 U	--	--	--
Silver	mg/kg dw	1 U	0.4 U	6	0.6 U	--	--	--
Thallium	mg/kg dw	0.3 U	0.3 U	0.3 U	0.4 U	--	--	--
Vanadium	mg/kg dw	41	46.6	38	67.7	--	--	--
Zinc	mg/kg dw	89 J	94 J	235 J	155	--	--	--
PAHs								
1-Methylnaphthalene	µg/kg dw	90	20 U	2,700	20 U	86 J	290 J	4,400 J
2-Chloronaphthalene	µg/kg dw	20 U	20 U	59 U	20 U	--	--	--
2-Methylnaphthalene	µg/kg dw	120	20 U	2,800	20 U	91 J	430 J	5,200 J
Acenaphthene	µg/kg dw	230	32	3,000	60	170 J	890 J	5,600 J
Acenaphthylene	µg/kg dw	70	89	350	73	130 J	130 J	80 UJ
Anthracene	µg/kg dw	290	290	6,500	390	390 J	2,300 J	11,000 J
Benzo(a)anthracene	µg/kg dw	430	410	9,000	740	980 J	2,300 J	16,000 J
Benzo(a)pyrene	µg/kg dw	480	440	7,800	760	1,400 J	3,200 J	12,000 J
Benzo(b)fluoranthene	µg/kg dw	870	420	5,400	890	--	--	--
Benzo(g,h,i)perylene	µg/kg dw	140	100	1,800	330 J	640 J	940 J	2,200 J
Benzo(k)fluoranthene	µg/kg dw	520	420	5,400	740	--	--	--
Total benzofluoranthenes	µg/kg dw	1,390	840	10,800	1,630	2,400 J	6,300 J	20,000 J
Chrysene	µg/kg dw	1,200	590	11,000	1,400	1,600 J	4,400 J	17,000 J
Dibenzo(a,h)anthracene	µg/kg dw	58 J	27	690	140 J	190 J	460 J	1,300 J
Dibenzofuran	µg/kg dw	330	26	1,100	46	93 J	640 J	2,100 J
Fluoranthene	µg/kg dw	2,900	830	20,000	2,100	3,500 J	11,000 J	44,000 J
Fluorene	µg/kg dw	290	65	3,800	110	210 J	1,100 J	8,300 J
Indeno(1,2,3-cd)pyrene	µg/kg dw	150	110	1,800	330 J	540 J	1,000 J	2,500 J
Naphthalene	µg/kg dw	210	20 U	3,000	22	240 J	980 J	5,600 J
Phenanthrene	µg/kg dw	3,400	310	24,000	740	2,600 J	7,900 J	62,000 J
Pyrene	µg/kg dw	1,600	820	20,000	1,500	3,800 J	9,100 J	52,000 J
Total HPAHs	µg/kg dw	8,300 J	4,170	83,000	8,900 J	15,100 J	39,000 J	167,000 J

East Waterway Surface Sediment Chemistry

Chemical	Unit	EW09-SS-015-010 6/23/2009	EW09-SS-016-010 6/22/2009	EW09-SS-018-010 6/22/2009	EW09-SS-020-010 3/4/2009	EW10-04-COMP 8/19/2009	EW10-05-COMP 8/19/2009	EW10-06-COMP 8/19/2009
Total LPAHs	µg/kg dw	4,500	790	41,000	1,400	3,700 J	13,300 J	93,000 J
cPAHs - mammal - half DL	µg/kg dw	710 J	590	10,000	1,100 J	1,900 J	4,400 J	17,000 J
Total PAHs	µg/kg dw	12,800 J	4,950	124,000	10,300 J	18,800 J	52,000 J	260,000 J
Phthalates								
Bis(2-ethylhexyl)phthalate	µg/kg dw	220	200	300	240	--	--	--
Butyl benzyl phthalate	µg/kg dw	47	15 U	15 U	27	--	--	--
Diethyl phthalate	µg/kg dw	15 U	20 U	46 U	15 U	--	--	--
Dimethyl phthalate	µg/kg dw	15 U	15 U	15 U	15 U	--	--	--
Di-n-butyl phthalate	µg/kg dw	20 U	55	59 U	20 U	--	--	--
Di-n-octyl phthalate	µg/kg dw	20 U	20 U	59 U	20 U	--	--	--
Other SVOCs								
1,2,4-Trichlorobenzene	µg/kg dw	6.1 U	6.0 U	5.9 U	6.1 U	--	--	--
1,2-Dichlorobenzene	µg/kg dw	6.1 U	6.0 U	5.9 U	6.1 U	--	--	--
1,3-Dichlorobenzene	µg/kg dw	20 U	20 U	59 U	20 U	--	--	--
1,4-Dichlorobenzene	µg/kg dw	6.7	6.0 U	5.9 U	15	--	--	--
2,4,5-Trichlorophenol	µg/kg dw	100 U	98 U	290 U	98 U	--	--	--
2,4,6-Trichlorophenol	µg/kg dw	100 U	98 U	290 U	98 U	--	--	--
2,4-Dichlorophenol	µg/kg dw	100 U	98 U	290 U	98 U	--	--	--
2,4-Dimethylphenol	µg/kg dw	6.1 U	6.0 U	15	6.1 U	--	--	--
2,4-Dinitrophenol	µg/kg dw	200 U	200 U	590 U	200 U	--	--	--
2,4-Dinitrotoluene	µg/kg dw	100 U	98 U	290 U	98 U	--	--	--
2,6-Dinitrotoluene	µg/kg dw	100 U	98 U	290 U	98 U	--	--	--
2-Chlorophenol	µg/kg dw	20 U	20 U	59 U	20 U	--	--	--
2-Methylphenol	µg/kg dw	6.1 U	6.0 U	13	6.1 U	--	--	--
2-Nitroaniline	µg/kg dw	100 U	98 U	290 U	98 U	--	--	--
2-Nitrophenol	µg/kg dw	100 U	98 U	290 U	98 U	--	--	--
3,3'-Dichlorobenzidine	µg/kg dw	100 U	98 U	290 U	98 U	--	--	--
3-Nitroaniline	µg/kg dw	100 U	98 U	290 U	98 U	--	--	--
4,6-Dinitro-o-cresol	µg/kg dw	200 U	200 U	590 U	200 U	--	--	--
4-Bromophenyl phenyl ether	µg/kg dw	20 U	20 U	59 U	20 U	--	--	--
4-Chloro-3-methylphenol	µg/kg dw	100 U	98 U	290 U	98 U	--	--	--
4-Chloroaniline	µg/kg dw	100 U	98 U	290 U	98 U	--	--	--
4-Chlorophenyl phenyl ether	µg/kg dw	20 U	20 U	59 U	20 U	--	--	--
4-Methylphenol	µg/kg dw	20 U	20 U	76	30	--	--	--
4-Nitroaniline	µg/kg dw	100 U	98 U	290 U	98 U	--	--	--
4-Nitrophenol	µg/kg dw	100 U	98 U	290 U	98 UJ	--	--	--
Aniline	µg/kg dw	R	20 UJ	59 UJ	20 U	--	--	--
Benzoic acid	µg/kg dw	200 UJ	200 U	590 U	200 U	--	--	--
Benzyl alcohol	µg/kg dw	20 U	20 U	30 U	20 UJ	--	--	--

East Waterway Surface Sediment Chemistry

Chemical	Unit	EW09-SS-015-010 6/23/2009	EW09-SS-016-010 6/22/2009	EW09-SS-018-010 6/22/2009	EW09-SS-020-010 3/4/2009	EW10-04-COMP 8/19/2009	EW10-05-COMP 8/19/2009	EW10-06-COMP 8/19/2009
bis(2-chloroethoxy)methane	µg/kg dw	20 U	20 U	59 U	20 U	--	--	--
bis(2-chloroethyl)ether	µg/kg dw	20 U	20 U	59 U	20 U	--	--	--
bis(2-chloroisopropyl)ether	µg/kg dw	20 U	20 U	59 U	20 U	--	--	--
Carbazole	µg/kg dw	260	66	2,200	110	--	--	--
Hexachlorobenzene	µg/kg dw	5.0 U	6.0 U	5.9 U	6.1 U	--	--	--
Hexachlorobutadiene	µg/kg dw	5.0 U	6.0 U	5.9 U	6.1 U	--	--	--
Hexachlorocyclopentadiene	µg/kg dw	100 U	98 U	290 U	98 U	--	--	--
Hexachloroethane	µg/kg dw	20 U	20 U	59 U	20 U	--	--	--
Isophorone	µg/kg dw	20 U	20 U	59 U	20 U	--	--	--
n-Nitroso-di-n-propylamine	µg/kg dw	30 U	30 U	30 U	31 U	--	--	--
n-Nitrosodimethylamine	µg/kg dw	30 U	30 U	30 U	31 U	--	--	--
n-Nitrosodiphenylamine	µg/kg dw	6.1 U	6.0 U	47 U	6.1 U	--	--	--
Nitrobenzene	µg/kg dw	20 U	20 U	59 U	20 U	--	--	--
Pentachlorophenol	µg/kg dw	30 U	30 U	30 U	31 U	--	--	--
Phenol	µg/kg dw	20 U	20 U	140	20	--	--	--
PCBs								
Aroclor-1016	µg/kg dw	13 U	23 U	10 U	19 U	--	--	--
Aroclor-1221	µg/kg dw	13 U	23 U	10 U	19 U	--	--	--
Aroclor-1232	µg/kg dw	13 U	23 U	10 U	19 U	--	--	--
Aroclor-1242	µg/kg dw	13 U	51	10 U	19 U	--	--	--
Aroclor-1248	µg/kg dw	48	23 U	25	19 U	--	--	--
Aroclor-1254	µg/kg dw	120	370	92	19 U	--	--	--
Aroclor-1260	µg/kg dw	170	420	140	29	--	--	--
Aroclor-1262	µg/kg dw	13 U	23 U	10 U	19 U	--	--	--
Aroclor-1268	µg/kg dw	13 U	23 U	10 U	19 U	--	--	--
Total PCBs	µg/kg dw	340	840	260	29	--	--	--
Pesticides								
2,4'-DDD	µg/kg dw	10 U	--	--	--	--	--	--
2,4'-DDE	µg/kg dw	10 U	--	--	--	--	--	--
2,4'-DDT	µg/kg dw	10 U	--	--	--	--	--	--
4,4'-DDD	µg/kg dw	10 U	--	--	--	--	--	--
4,4'-DDE	µg/kg dw	10 U	--	--	--	--	--	--
4,4'-DDT	µg/kg dw	10 U	--	--	--	--	--	--
Total DDTs	µg/kg dw	10 U	--	--	--	--	--	--
Aldrin	µg/kg dw	270 U	--	--	--	--	--	--
Dieldrin	µg/kg dw	10 U	--	--	--	--	--	--
Total aldrin/dieldrin	µg/kg dw	270 U	--	--	--	--	--	--
alpha-BHC	µg/kg dw	5.0 U	--	--	--	--	--	--
beta-BHC	µg/kg dw	5.0 U	--	--	--	--	--	--

East Waterway Surface Sediment Chemistry

Chemical	Unit	EW09-SS-015-010 6/23/2009	EW09-SS-016-010 6/22/2009	EW09-SS-018-010 6/22/2009	EW09-SS-020-010 3/4/2009	EW10-04-COMP 8/19/2009	EW10-05-COMP 8/19/2009	EW10-06-COMP 8/19/2009
gamma-BHC	µg/kg dw	5.0 U	--	--	--	--	--	--
delta-BHC	µg/kg dw	5.0 U	--	--	--	--	--	--
alpha-Chlordane	µg/kg dw	5.0 U	--	--	--	--	--	--
gamma-Chlordane	µg/kg dw	5.0 U	--	--	--	--	--	--
Total chlordane	µg/kg dw	10 U	--	--	--	--	--	--
alpha-Endosulfan	µg/kg dw	5.0 U	--	--	--	--	--	--
beta-Endosulfan	µg/kg dw	10 U	--	--	--	--	--	--
Endosulfan sulfate	µg/kg dw	10 U	--	--	--	--	--	--
Endrin	µg/kg dw	10 U	--	--	--	--	--	--
Endrin aldehyde	µg/kg dw	10 U	--	--	--	--	--	--
Endrin ketone	µg/kg dw	10 U	--	--	--	--	--	--
Heptachlor	µg/kg dw	5.0 U	--	--	--	--	--	--
Heptachlor epoxide	µg/kg dw	5.0 U	--	--	--	--	--	--
Methoxychlor	µg/kg dw	50 U	--	--	--	--	--	--
Mirex	µg/kg dw	10 U	--	--	--	--	--	--
cis-Nonachlor	µg/kg dw	10 U	--	--	--	--	--	--
trans-Nonachlor	µg/kg dw	10 U	--	--	--	--	--	--
Oxychlordane	µg/kg dw	10 U	--	--	--	--	--	--
Toxaphene	µg/kg dw	500 U	--	--	--	--	--	--
Grain size								
Total gravel	% dw	32.5	55.8	32.0	3.5	--	--	--
Total sand	% dw	40.8	42.2	63.8	18.4	--	--	--
Total silt	% dw	16.9	--	--	45.3	--	--	--
Total clay	% dw	9.7	--	--	32.9	--	--	--
Total fines (percent silt+clay)	% dw	26.6	--	--	78.2	--	--	--
Conventionals								
Ammonia	mg-N/kg dw	7.57	3.68	3.71	18.8	--	--	--
Total organic carbon (TOC)	% dw	3.15	1.47	3.28	2.58	--	--	--
Total solids	% ww	60.50	66.40	69.90	47.20	--	--	--
Total solids (preserved)	% ww	60.80	76.00	73.00	44.60	--	--	--
Total sulfides	mg/kg dw	156 J	745 J	1,790 J	1,030 J	--	--	--

Notes:
µg/kg: micrograms per kilogram
mg/kg: milligrams per kilogram
ng/kg: nanograms per kilogram
OCDD: octachlorodibenzodioxin
OCDF: octachlorodibenzofuran
PCB: polychlorinated biphenyl
TEQ: toxic equivalency quotient

East Waterway Subsurface Sediment Chemistry

		EW10-SC06					EW10-SC08					EW10-SC09				
		EW10-SC06-0-2	EW10-SC06-2-4	EW10-SC06-4-6	EW10-SC06-6-7.4	EW10-SC06-7.4-10	EW10-SC08-0-2	EW10-SC08-2-4	EW10-SC08-6-8	EW10-SC08-8-9.4	EW10-SC08-9.4-11	EW10-SC09-0-2	EW10-SC09-2-4	EW10-SC09-6-7.2	EW10-SC09-7.2-9.2	EW10-SC09-9.2-11.2
		0 - 2 ft	2 - 4 ft	4 - 6 ft	6 - 7.4 ft	7.4 - 10 ft	0 - 2 ft	2 - 4 ft	6 - 8 ft	8 - 9.4 ft	9.4 - 11	0 - 2 ft	2 - 4 ft	6 - 7.2 ft	7.2 - 9.2 ft	9.2 - 11.2 ft
Chemical	**Unit**	2/22/2010	2/22/2010	2/22/2010	2/22/2010	2/22/2010	2/22/2010	2/22/2010	2/22/2010	2/22/2010	2/22/2010	3/9/2010	3/9/2010	3/9/2010	3/9/2010	3/9/2010
Metals																
Antimony	mg/kg dw	10 UJ	10 UJ	--	--	--	9 UJ	10 UJ	--	--	--	10 UJ	10 UJ	--	--	--
Arsenic	mg/kg dw	24.4	13.6	--	--	--	18.5	22.5	--	--	--	21.5	21.5	--	--	--
Cadmium	mg/kg dw	3.1	3.6	--	--	--	2.1	5.6	1.2	--	--	2.1	3.1	--	--	--
Chromium	mg/kg dw	72	45	--	--	--	53.9	118	--	--	--	52	72	--	--	--
Cobalt	mg/kg dw	10.5	6.5	--	--	--	13.1	16.4	--	--	--	9.9	11.0	--	--	--
Copper	mg/kg dw	130	70.2	--	--	--	129	157	--	--	--	126	141	--	--	--
Lead	mg/kg dw	197	169	--	--	--	162	272	--	--	--	155	253	--	--	--
Mercury	mg/kg dw	0.90	0.80	0.71	0.28	0.02 U	0.49	1.00	0.43	0.04	0.03 U	0.51 J	0.89 J	0.74	0.03 U	0.03 U
Molybdenum	mg/kg dw	6	9	--	--	--	3.7	7	--	--	--	4	5	--	--	--
Nickel	mg/kg dw	31	20	--	--	--	39	62	--	--	--	27	32	--	--	--
Selenium	mg/kg dw	1 U	1 U	--	--	--	0.9 U	1 U	--	--	--	1	1	--	--	--
Silver	mg/kg dw	3.7	1.8	--	--	--	1.6	5.8	--	--	--	1.3	2.6	--	--	--
Thallium	mg/kg dw	0.4 U	0.4 U	--	--	--	0.4 U	0.5	--	--	--	0.4 U	0.5 U	--	--	--
Vanadium	mg/kg dw	74.7	60.8	--	--	--	82.9	84.3	--	--	--	70.3	76.5	--	--	--
Zinc	mg/kg dw	287	253	--	--	--	321	382	--	--	--	282	350	--	--	--
Organometals																
Monobutyltin as ion	µg/kg dw	3.6 U	3.8 U	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibutyltin as ion	µg/kg dw	15	5.3 U	--	--	--	--	--	--	--	--	--	--	--	--	--
Tributyltin as ion	µg/kg dw	63 J	4.5 J	--	--	--	--	--	--	--	--	--	--	--	--	--
PAHs																
1-Methylnaphthalene	µg/kg dw	32 U	19 J	--	--	--	28 U	20 J	19 UJ	--	--	94	67	270 J	260	--
2-Chloronaphthalene	µg/kg dw	32 U	34 U	--	--	--	28 U	37 U	19 U	--	--	20 U	20 U	420 U	20 U	--
2-Methylnaphthalene	µg/kg dw	18 J	28 J	--	--	--	15 J	39	19 U	--	--	82	66	420 U	40	--
Acenaphthene	µg/kg dw	32 U	47	--	--	--	14 J	37 U	92	--	--	170	110	770	160	--
Acenaphthylene	µg/kg dw	37	38	--	--	--	34	37 U	19 U	--	--	110	200	220 J	20 U	--
Anthracene	µg/kg dw	90	180	--	--	--	90	290	160	--	--	630	1,400	3,000	20 U	--
Benzo(a)anthracene	µg/kg dw	140	330	--	--	--	170	560	160	--	--	760	2,400	3,600	20 U	--
Benzo(a)pyrene	µg/kg dw	350	330	--	--	--	360	520	110	--	--	1,300	2,300	2,500	20 U	--
Benzo(g,h,i)perylene	µg/kg dw	100	100	--	--	--	110	140	59	--	--	250	400	880	20 U	--
Total benzofluoranthenes	µg/kg dw	720	600	--	--	--	680	800	190	--	--	1,900	2,800	4,400	20 U	--
Chrysene	µg/kg dw	240	460	--	--	--	300	700	230	--	--	1,800	3,500	3,800	20 U	--
Dibenzo(a,h)anthracene	µg/kg dw	62	48 J	--	--	--	62	29 J	19 J	--	--	240 J	240 J	430	6.2 U	--
Dibenzofuran	µg/kg dw	32 U	36	--	--	--	28 U	25 J	56	--	--	52	63	340 J	20 U	--
Fluoranthene	µg/kg dw	250	810	--	--	--	260	1,200	680	--	--	1,900	3,000	8,100	20 U	--
Fluorene	µg/kg dw	17 J	68	--	--	--	20 J	57	120	--	--	220	180	900	20 U	--
Indeno(1,2,3-cd)pyrene	µg/kg dw	110	100	--	--	--	120	140	51	--	--	260	430	860	20 U	--
Naphthalene	µg/kg dw	31 J	73	--	--	--	29	33 J	17 J	--	--	94	130	680	950	--
Phenanthrene	µg/kg dw	130	260	--	--	--	120	170	680	--	--	1,500	1,000	3,700	20 U	--
Pyrene	µg/kg dw	640	810	--	--	--	520	1,500	580	--	--	2,600 J	4,300 J	10,000	20 U	--
Total HPAHs	µg/kg dw	2,610	3,590 J	--	--	--	2,580	5,600 J	2,080 J	--	--	11,000 J	19,400 J	35,000	20 U	--
Total LPAHs	µg/kg dw	310 J	670	--	--	--	310 J	550 J	1,070 J	--	--	2,700	3,000	9,300 J	1,110	--
cPAHs - mammal - half DL	µg/kg dw	470	460 J	--	--	--	480	690 J	160 J	--	--	1,700 J	3,000 J	3,600	14 U	--
Total PAHs	µg/kg dw	2,920 J	4,250 J	--	--	--	2,890 J	6,100 J	3,150 J	--	--	13,700 J	22,400 J	44,000 J	1,110	--
Phthalates																
Bis(2-ethylhexyl)phthalate	µg/kg dw	880 U	470 U	--	--	--	610 U	3,300	18 J	--	--	260	630	1,800	23	--
Butyl benzyl phthalate	µg/kg dw	63 J	15 U	--	--	--	55 J	66 J	18 J	--	--	47	76	52 J	16 U	--
Diethyl phthalate	µg/kg dw	32 U	34 U	--	--	--	28 U	37 U	15 U	--	--	20 U	20 U	15 U	20 U	--
Dimethyl phthalate	µg/kg dw	16 J	15 U	--	--	--	15 U	15 U	15 U	--	--	19	16	15 U	16 U	--
Di-n-butyl phthalate	µg/kg dw	32 U	34 U	--	--	--	28 U	37 U	19 U	--	--	44	20 U	420 U	20 U	--
Di-n-octyl phthalate	µg/kg dw	32 U	34 U	--	--	--	28 U	37 U	19 U	--	--	20 U	20 U	420 U	20 U	--
Other SVOCs																
1,2,4-Trichlorobenzene	µg/kg dw	15 J	6.1 U	--	--	--	6.0 U	6.1 U	6.0 U	--	--	6.1 U	7.4	14 U	6.2 U	--
1,2-Dichlorobenzene	µg/kg dw	6.1 U	6.1 U	--	--	--	6.0 U	6.1 U	6.0 U	--	--	6.1 U	6.2 U	6.1 U	6.2 U	--
1,3-Dichlorobenzene	µg/kg dw	32 U	34 U	--	--	--	28 U	37 U	19 U	--	--	20 U	20 U	420 U	20 U	--
1,4-Dichlorobenzene	µg/kg dw	12	6.1 U	--	--	--	16	15	6.0 U	--	--	21	15	8.5	6.2 U	--
2,4,5-Trichlorophenol	µg/kg dw	160 U	170 U	--	--	--	140 U	180 U	97 U	--	--	98 U	99 U	2,100 U	98 U	--
2,4,6-Trichlorophenol	µg/kg dw	160 U	170 U	--	--	--	140 U	180 U	97 U	--	--	98 U	99 U	2,100 U	98 U	--
2,4-Dichlorophenol	µg/kg dw	160 U	170 U	--	--	--	140 U	180 U	97 U	--	--	98 U	99 U	2,100 U	98 U	--
2,4-Dimethylphenol	µg/kg dw	6.1 U	6.1 U	--	--	--	6.0 U	6.1 U	6.0 U	--	--	20	17	6.1 U	8.7	--
2,4-Dinitrophenol	µg/kg dw	320 U	340 U	--	--	--	280 U	370 U	190 U	--	--	200 U	200 U	4,200 U	200 U	--
2,4-Dinitrotoluene	µg/kg dw	160 U	170 U	--	--	--	140 U	180 U	97 U	--	--	98 U	99 U	2,100 U	98 U	--
2,6-Dinitrotoluene	µg/kg dw	160 U	170 U	--	--	--	140 U	180 U	97 U	--	--	98 U	99 U	2,100 U	98 U	--
2-Chlorophenol	µg/kg dw	32 U	34 U	--	--	--	28 U	37 U	19 U	--	--	20 U	20 U	420 U	20 U	--
2-Methylphenol	µg/kg dw	6.1 U	6.1 U	--	--	--	6.0 U	6.1 U	6.0 U	--	--	8.5	7.4	6.1 U	6.2 U	--
2-Nitroaniline	µg/kg dw	160 U	170 U	--	--	--	140 U	180 U	97 U	--	--	98 U	99 U	2,100 U	98 U	--
2-Nitrophenol	µg/kg dw	160 U	170 U	--	--	--	140 U	180 U	19 U	--	--	98 U	99 U	420 U	20 U	--
3,3'-Dichlorobenzidine	µg/kg dw	160 U	170 U	--	--	--	140 U	180 U	97 U	--	--	98 U	99 U	2,100 U	98 U	--
3-Nitroaniline	µg/kg dw	160 U	170 U	--	--	--	140 U	180 U	97 U	--	--	98 U	99 U	2,100 U	98 U	--
4,6-Dinitro-o-cresol	µg/kg dw	320 U	340 U	--	--	--	280 U	370 U	190 U	--	--	200 U	200 U	4,200 U	200 U	--
4-Bromophenyl phenyl ether	µg/kg dw	32 U	34 U	--	--	--	28 U	37 U	19 U	--	--	20 U	20 U	420 U	20 U	--
4-Chloro-3-methylphenol	µg/kg dw	160 U	170 U	--	--	--	140 U	180 U	97 U	--	--	98 U	99 U	2,100 U	98 U	--

East Waterway Subsurface Sediment Chemistry

		EW10-SC06					EW10-SC08					EW10-SC09				
		EW10-SC06-0-2	EW10-SC06-2-4	EW10-SC06-4-6	EW10-SC06-6-7.4	EW10-SC06-7.4-10	EW10-SC08-0-2	EW10-SC08-2-4	EW10-SC08-6-8	EW10-SC08-8-9.4	EW10-SC08-9.4-11	EW10-SC09-0-2	EW10-SC09-2-4	EW10-SC09-6-7.2	EW10-SC09-7.2-9.2	EW10-SC09-9.2-11.2
		0 - 2 ft	2 - 4 ft	4 - 6 ft	6 - 7.4 ft	7.4 - 10 ft	0 - 2 ft	2 - 4 ft	6 - 8 ft	8 - 9.4 ft	9.4 - 11	0 - 2 ft	2 - 4 ft	6 - 7.2 ft	7.2 - 9.2 ft	9.2 - 11.2 ft
Chemical	**Unit**	2/22/2010	2/22/2010	2/22/2010	2/22/2010	2/22/2010	2/22/2010	2/22/2010	2/22/2010	2/22/2010	2/22/2010	3/9/2010	3/9/2010	3/9/2010	3/9/2010	3/9/2010
4-Chloroaniline	µg/kg dw	160 U	170 U	--	--	--	140 U	180 U	97 U	--	--	98 U	99 U	2,100 U	98 U	--
4-Chlorophenyl phenyl ether	µg/kg dw	32 U	34 U	--	--	--	28 U	37 U	19 U	--	--	20 U	20 U	420 U	20 U	--
4-Methylphenol	µg/kg dw	20 J	76	--	--	--	15 J	37 U	19 U	--	--	16 J	18 J	420 U	20 U	--
4-Nitroaniline	µg/kg dw	160 U	170 U	--	--	--	140 U	180 U	97 U	--	--	98 U	99 U	2,100 U	98 U	--
4-Nitrophenol	µg/kg dw	160 U	170 U	--	--	--	140 U	180 U	97 U	--	--	98 U	99 U	2,100 U	98 U	--
Aniline	µg/kg dw	32 U	34 U	--	--	--	28 U	37 U	19 U	--	--	20 U	20 U	420 U	20 U	--
Benzoic acid	µg/kg dw	320 U	340 U	--	--	--	280 U	370 U	190 U	--	--	200 U	71 J	4,200 U	200 U	--
Benzyl alcohol	µg/kg dw	32 U	34 U	--	--	--	28 U	37 U	19 U	--	--	20 U	20 U	30 U	20 U	--
bis(2-chloroethoxy)methane	µg/kg dw	32 U	34 U	--	--	--	28 U	37 U	19 U	--	--	20 U	20 U	420 U	20 U	--
bis(2-chloroethyl)ether	µg/kg dw	32 U	34 U	--	--	--	28 U	37 U	19 U	--	--	20 U	20 U	420 U	20 U	--
bis(2-chloroisopropyl)ether	µg/kg dw	32 U	34 U	--	--	--	28 U	37 U	19 U	--	--	20 U	20 U	420 U	20 U	--
Carbazole	µg/kg dw	32 U	34 U	--	--	--	28	37 U	19 J	--	--	170	250	280 J	110	--
Hexachlorobenzene	µg/kg dw	6.1 U	6.1 U	--	--	--	6.0 U	6.1 U	6.0 U	--	--	6.1 U	6.2 U	6.1 U	6.2 U	--
Hexachlorobutadiene	µg/kg dw	6.1 U	6.1 U	--	--	--	6.0 U	6.1 U	6.0 U	--	--	6.1 U	6.2 U	6.1 U	6.2 U	--
Hexachlorocyclopentadiene	µg/kg dw	160 U	170 U	--	--	--	140 U	180 UJ	97 U	--	--	98 UJ	99 UJ	2,100 U	98 U	--
Hexachloroethane	µg/kg dw	32 U	34 U	--	--	--	28 U	37 U	19 U	--	--	20 U	20 U	420 U	20 U	--
Isophorone	µg/kg dw	32 U	34 U	--	--	--	28 U	37 U	19 U	--	--	20 U	20 U	420 U	20 U	--
n-Nitroso-di-n-propylamine	µg/kg dw	30 U	31 U	--	--	--	30 U	30 U	30 U	--	--	30 U	31 U	34 J	31 U	--
n-Nitrosodimethylamine	µg/kg dw	30 U	31 U	--	--	--	30 U	30 U	30 U	--	--	30 U	31 U	30 U	31 U	--
n-Nitrosodiphenylamine	µg/kg dw	7.3 U	6.1 U	--	--	--	6.6 U	21 U	8.4 U	--	--	10 U	20 U	46 U	6.2 U	--
Nitrobenzene	µg/kg dw	32 U	34 U	--	--	--	28 U	37 U	19 U	--	--	20 U	20 U	420 U	20 U	--
Pentachlorophenol	µg/kg dw	30 U	31 U	--	--	--	30 U	52	30 U	--	--	30 U	81	30 U	31 U	--
Phenol	µg/kg dw	32 U	34 U	--	--	--	28 U	37 U	19 U	--	--	20 U	20 U	420 U	33	--
PCBs																
Aroclor-1016	µg/kg dw	41 U	3.9 U	--	--	--	40 U	110 U	3.9 U	--	--	49 U	48 U	37 U	19 U	--
Aroclor-1221	µg/kg dw	41 U	3.9 U	--	--	--	40 U	110 U	3.9 U	--	--	49 U	48 U	37 U	19 U	--
Aroclor-1232	µg/kg dw	41 U	3.9 U	--	--	--	40 U	110 U	3.9 U	--	--	49 U	48 U	37 U	19 U	--
Aroclor-1242	µg/kg dw	250	3.9 U	--	--	--	180	110 U	3.9 U	--	--	49 U	48 U	37 U	19 U	--
Aroclor-1248	µg/kg dw	41 U	20 U	--	--	--	40 U	2,400	3.9 U	--	--	140	240	340	19 U	--
Aroclor-1254	µg/kg dw	1,000	37 J	--	--	--	540	2,800	3.9 U	--	--	390	660	620	19 U	--
Aroclor-1260	µg/kg dw	1,300	72	--	--	--	680	2,000	3.9 U	--	--	640	1,000	760	19 U	--
Aroclor-1262	µg/kg dw	41 U	3.9 U	--	--	--	40 U	110 U	3.9 U	--	--	49 U	48 U	37 U	19 U	--
Aroclor-1268	µg/kg dw	41 U	3.9 U	--	--	--	40 U	110 U	3.9 U	--	--	49 U	48 U	37 U	19 U	--
Total PCBs	µg/kg dw	2,600	109 J	--	--	--	1,400	7,200	3.9 U	--	--	1,170	1,900	1,720	19 U	--
Dioxin/furan																
2,3,7,8-TCDD	ng/kg dw	--	--	--	0.319 J	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-PeCDD	ng/kg dw	--	--	--	0.910 J	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-HxCDD	ng/kg dw	--	--	--	1.10 J	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HxCDD	ng/kg dw	--	--	--	0.864 J	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HxCDD	ng/kg dw	--	--	--	0.885 J	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-HpCDD	ng/kg dw	--	--	--	6.30	--	--	--	--	--	--	--	--	--	--	--
OCDD	ng/kg dw	--	--	--	24.4	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDF	ng/kg dw	--	--	--	1.42	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-PeCDF	ng/kg dw	--	--	--	0.934 J	--	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-PeCDF	ng/kg dw	--	--	--	1.02 J	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-HxCDF	ng/kg dw	--	--	--	0.598 J	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HxCDF	ng/kg dw	--	--	--	0.557 J	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HxCDF	ng/kg dw	--	--	--	2.43 U	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-HxCDF	ng/kg dw	--	--	--	0.480 J	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-HpCDF	ng/kg dw	--	--	--	1.04 J	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-HpCDF	ng/kg dw	--	--	--	2.43 U	--	--	--	--	--	--	--	--	--	--	--
OCDF	ng/kg dw	--	--	--	0.435 J	--	--	--	--	--	--	--	--	--	--	--
Total TCDD	ng/kg dw	--	--	--	64.0 J	--	--	--	--	--	--	--	--	--	--	--
Total PeCDD	ng/kg dw	--	--	--	64.5 J	--	--	--	--	--	--	--	--	--	--	--
Total HxCDD	ng/kg dw	--	--	--	41.3 J	--	--	--	--	--	--	--	--	--	--	--
Total HpCDD	ng/kg dw	--	--	--	13.9	--	--	--	--	--	--	--	--	--	--	--
Total TCDF	ng/kg dw	--	--	--	32.7 J	--	--	--	--	--	--	--	--	--	--	--
Total PeCDF	ng/kg dw	--	--	--	12.6 J	--	--	--	--	--	--	--	--	--	--	--
Total HxCDF	ng/kg dw	--	--	--	5.04 J	--	--	--	--	--	--	--	--	--	--	--
Total HpCDF	ng/kg dw	--	--	--	1.38	--	--	--	--	--	--	--	--	--	--	--
Dioxin/furan TEQ - bird (half DL)	ng/kg dw	--	--	--	4.23 J	--	--	--	--	--	--	--	--	--	--	--
Dioxin/furan TEQ - fish (half DL)	ng/kg dw	--	--	--	2.74 J	--	--	--	--	--	--	--	--	--	--	--
Dioxin/furan TEQ - mammal (half DL)	ng/kg dw	--	--	--	2.37 J	--	--	--	--	--	--	--	--	--	--	--
Grain size																
Total gravel	% dw	0.7	3.9	--	--	--	0.1 U	0.4	--	--	--	7.5	5.6	--	--	--
Total sand	% dw	20.6	56.7	--	--	--	13.4	16.6	--	--	--	23.2	23.2	--	--	--
Total silt	% dw	47.7	20.3	--	--	--	50.1	48.2	--	--	--	46.9	43.0	--	--	--
Total clay	% dw	31.2	19.0	--	--	--	36.5	34.9	--	--	--	22.5	28.3	--	--	--
Total fines (percent silt+clay)	% dw	78.9	39.3	--	--	--	86.6	83.1	--	--	--	69.4	71.3	--	--	--
Conventionals																
Total organic carbon (TOC)	% dw	3.69	7.40	4.32	2.32	1.18	1.45	2.42	2.29	0.694	0.427	3.99	5.29	4.39	0.403	0.424
Total solids	% ww	48.70	48.20	47.87	60.40	78.50	50.10	47.60	59.20	70.30	77.80	40.80	40.70	52.60	77.30	75.70

East Waterway Subsurface Sediment Chemistry

		EW10-SC06					EW10-SC08					EW10-SC09				
		EW10-SC06-0-2	EW10-SC06-2-4	EW10-SC06-4-6	EW10-SC06-6-7.4	EW10-SC06-7.4-10	EW10-SC08-0-2	EW10-SC08-2-4	EW10-SC08-6-8	EW10-SC08-8-9.4	EW10-SC08-9.4-11	EW10-SC09-0-2	EW10-SC09-2-4	EW10-SC09-6-7.2	EW10-SC09-7.2-9.2	EW10-SC09-9.2-11.2
		0 - 2 ft	2 - 4 ft	4 - 6 ft	6 - 7.4 ft	7.4 - 10 ft	0 - 2 ft	2 - 4 ft	6 - 8 ft	8 - 9.4 ft	9.4 - 11	0 - 2 ft	2 - 4 ft	6 - 7.2 ft	7.2 - 9.2 ft	9.2 - 11.2 ft
Chemical	**Unit**	2/22/2010	2/22/2010	2/22/2010	2/22/2010	2/22/2010	2/22/2010	2/22/2010	2/22/2010	2/22/2010	2/22/2010	3/9/2010	3/9/2010	3/9/2010	3/9/2010	3/9/2010

Notes:
µg/kg: micrograms per kilogram
mg/kg: milligrams per kilogram
ng/kg: nanograms per kilogram
OCDD: octachlorodibenzodioxin
OCDF: octachlorodibenzofuran
PCB: polychlorinated biphenyl
TEQ: toxic equivalency quotient